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ABSTRACT

Information on the current and projected supply of and demand for graduates of higher education in the food and agricultural sciences is presented, based on federal data bases. The supply data are aggregated by 11 educational clusters, and employment demand data are aggregated by eight occupational clusters. Analysis reveals imbalances in the supply of, and demand for, graduates of higher education in the food and agricultural sciences. When total supply is related to total demand for each of the eight occupational clusters, shortages of qualified graduates appear to exist through 1985 for five clusters: scientific and professional specialists, manufacturing and processing scientists and engineers, sales and service representatives and purchasing agents, administrators/managers/financial advisors, and miscellaneous agricultural specialists. Supply approximates demand for agricultural production and management specialists, and exceeds demand for media specialists and educators. However, several supply deficiencies were identified for educators. Information is presented on supply/demand relationships by occupational cluster, degree type (agriculture and agriculture-related), and degree level (associate, baccalaureate, master's, doctoral, and Doctor of Veterinary Medicine). Suggestions for future research on this topic are presented, and additional information is included on international employment opportunities for food and agricultural graduates. Findings pertinent to data collection for the Foreign Agricultural Service and those stemming from the review of existing data are discussed. (SW)

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Graduates of Higher Education in the Food and Agricultural Sciences:

An Analysis of Supply/Demand Relationships

Volume I—Agriculture, Natural Resources, and Veterinary Medicine

Edited by
Kyle Jane Coulter
and
Marge Stanton

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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Several professional organizations provided initial recommendations for conducting the project. Foremost among these were the American Association of University Agricultural Administrators (AAUAA) of the American Association of State Colleges and Universities (AASCU), and the Resident Instruction Section of the Division of Agriculture, National Association of State Universities and Land-Grant Colleges (NASULGC). The AAUAA appointed Charles M. Smallwood as liaison to the project. The Resident Instruction Section appointed the following members to serve as a panel of consultants to the project coordinator: Stephen R. Chapman, J. Robert Cooke, Ed Glazener, Allan Goecker, Richard Merritt, and Winston E. Pullen.

The following organizations also expressed interest in the project and provided guidance and direction: the Council of Forestry School Executives, the Association of State College and University Forestry Research Organizations, the Society of American Foresters, the Association of American Veterinary Medical Colleges, the Federal Interagency Committee on Plant Sciences, the Federal Interdepartmental Committee on Employment Opportunities and Training Needs in Agriculture, and the National Plant Genetics Resources Board.

Within USDA, many individuals contributed to the project. Anson R. Bertrand, Director, Science and Education, and Homer C. Folks, Assistant Director, Higher Education, gave administrative support. Josefina Lago and Marge Stanton, Communications and Data Services Division, SEA, were responsible for analyzing the data pertaining to the supply of graduates of higher education in the food and agricultural sciences. Dennis Clark, also with the Communications and Data Services Division, provided guidance in processing the Cooperative Extension Services data. Jane Hart and Cheryl Cohen, Higher Education, provided clerical assistance. Deborah Gerald, National Center for Education Statistics, helped prepare projections for future graduates in food and agriculture.

Data used in the project were made available by the National Center for Education Statistics, the Bureau of Labor Statistics, SEA-Extension, the American Vocational Association, the Foreign Agricultural Service, and the Department of Defense. A USDA-SEA funded Clemson University project, directed by Stephen R. Chapman and Edward L. McLean, was responsible for collecting and analyzing the data for teaching and research faculty employment in higher education.

Program Resources, Inc. (PRI) developed the overall project design, identified and processed the employment demand data, analyzed supply/demand relationships, and helped prepare the final report. Representing PRI were David Lipstein, David Mixer, Jane Burgess, Trish Carrico, and Betty Johnson.

The panel of consultants from the Resident Instruction Section, Division of Agriculture, NASULGC, reviewed the report. In addition, the Joint Council on Food and Agricultural Sciences appointed the following group to review the report: T. H. Blosser, Robert Coltrane, Rudy M. Kallander, Fred B. Knight, and Charles M. Smallwood.

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EXECUTIVE SUMMARY

This report--prepared by the Office of Higher Education, Science and Education Administration (SEA), U.S. Department of Agriculture (USDA)--provides information on the current and projected supply of and demand for graduates of higher education in the food and agricultural sciences.

Purpose

The purpose of this report is threefold: (1) to identify current and projected supplies of new graduates of higher education qualified for employment in food and agriculture-related positions; (2) to identify current and projected occupational employment demand for graduates of higher education in the food and agricultural sciences; and (3) to analyze and interpret supply/demand relationships, thereby providing insight into the extent to which higher education in the food and agricultural sciences is producing sufficient graduates to complement needs of the labor force.

Overview of the Methodology

The project responsible for this report primarily used data bases from agencies of the Federal Government. Information on the supply of higher education graduates was obtained principally from the Higher Education General Information Surveys administered by the National Center for Education Statistics; the only exception was for data pertaining to graduates certified as secondary vocational agriculture teachers, which were acquired from the American Vocational Association. Occupational employment demand information was obtained primarily through the Occupational Employment Statistics Program of the Bureau of Labor Statistics (BLS). In addition to BLS data, USDA data were used to assess employment demand in the Cooperative Extension Services, and a USDA-funded study by Clemson University provided data on college and university teaching and research faculty employment.

The supply data are aggregated and presented by 11 educational clusters: General Agriculture; Agricultural Business and Management; Agricultural Engineering; Agricultural-Related Sciences; Agricultural Social Sciences; Animal Sciences; Food Sciences; International Agriculture; Natural Resources; Plant Sciences; and Soil Sciences. The 8 occupational clusters used to aggregate and present the employment demand data are: Scientific and Professional Specialists; Manufacturing and Processing Scientists and Engineers; Sales and Service Representatives and Purchasing Agents; Administrators, Managers, and Financial Advisors; Educators; Media Specialists; Agricultural Production and Management Specialists; and Miscellaneous Agricultural Specialists. Supply/demand relationships focus on associations between the 11 educational clusters and the 8 occupational clusters.

Throughout the project, a panel of consultants representing the Resident Instruction Section of the Division of Agriculture, NASULGC, and a liaison representative of the American Association of University Agricultural Administrators, AASCU, provided suggestions and guidance. This panel afforded the necessary expertise to overcome the inherent limitations due to the paucity of existing data as well as the inconsistent and incompatible data classification systems of the different information bases. Without such expertise, the development of a single analytical model would not have been possible.

Summary Conclusions

The study shows imbalances in the supply of, and demand for, graduates of higher education in the food and agricultural sciences. Through the mid-1980's, estimated

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supplies of associate and baccalaureate degree recipients appear to be adequate for most types of employment demand. Current and projected supplies of graduates with advanced degrees do not appear to satisfy employment demand.

To strengthen the food/agriculture labor force, the United States needs more master's graduates in Agricultural Business and Management, Agricultural Engineering, Animal Sciences, Food Sciences, Natural Resources, Plant Sciences, and Soil Sciences. At the doctoral level, we need more graduates in Agricultural Business and Management, Agricultural Engineering, Animal Sciences, Food Sciences, Forest Engineering, Forest Products Utilization, Plant Sciences, and Soil Sciences. In addition, this study projects shortages of graduates in selected specialties in Veterinary Medicine (for example, regulatory medicine, pathology).

Limitations

The project represents the first phase of a continuing effort to conduct a comprehensive supply/demand analysis of graduates of higher education in the food and agricultural sciences. For brevity, this report presents supply information pertaining only to degrees conferred by all institutions. Future reports will address sex, race, and ethnicity of graduates, as well as type of institution (for example, land-grant, nonland-grant).

A comprehensive data base does not exist for analyzing supply and demand components of the food and agricultural labor force sectors. Therefore, the project employed an innovative, experimental methodology to develop estimates for: percentages of graduates of the various degree specializations qualified for food/agriculture employment; percentages of workers in given occupations who possess higher education in food/agriculture; and percentage distributions of graduates of various degree specializations among the 8 occupational clusters established for the project. Future studies will refine and validate this research design.

Graduates of Higher Education in the Food and Agricultural Sciences:

An Analysis of Supply/Demand Relationships

Volume I—Agriculture, Natural Resources, and Veterinary Medicine

Edited by Kyle Jane Coulter and Marge Stanton *

CHAPTER I

Introduction

The Food and Agriculture Act of 1977 (PL 95-113), Title XIV, Subtitle B, Section 1405 states:

> The Department of Agriculture is designated as the lead agency of the Federal Government for agriculture research,...extension, and teaching in the food and agricultural sciences, and the Secretary, in carrying out the Secretary's responsibilities shall...keep informed of developments in, and the Nation's need for research, extension, teaching, and manpower development in the food and agricultural sciences and represent such need in deliberations within the Department of Agriculture, elsewhere within the executive branch of the United States Government, and with the several States and their designated land-grant colleges and universities, agricultural and related industries, and other interested institutions and groups.

The Science and Education Administration (SEA) of the U.S. Department of Agriculture (USDA) is mandated to carry out the Secretary's responsibilities as cited.

Recognizing the foregoing, the Office of Higher Education, SEA, USDA, conducted a comprehensive analysis of the occupational structure of the food and agriculture sector of the Nation's economy and the extent to which higher education is producing the specific types of graduates required by the total spectrum of food and agricultural industries. The basic focus of the project was to identify current and projected employment opportunities for graduates of higher education programs in the food and agricultural sciences. In designing and carrying out the project, the following definitions were used:

Food and Agricultural Sciences--academic programs concerned with the production, processing, marketing, distribution, conservation, consumption, research and development of food and agriculturally related products and services, inclusive of programs in natural resources, forestry, veterinary medicine, and home economics.

Graduates of Higher Education Programs--current and projected recipients of an associate, baccalaureate, master's, doctorate, or first professional degree awarded

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*Kyle Jane Coulter is Deputy Assistant Director, Office of Higher Education, SEA, and Marge Stanton is statistician, Communications and Data Services Division, SEA, USDA, Washington, D.C. 20250.

by any accredited public or private institution of higher (postsecondary) education. A Doctor of Veterinary Medicine (D.V.M.) was considered a first professional degree.

Employment Opportunities--current and projected levels of employment, as well as projected average annual job openings in those occupations related to the broad spectrum of food and agriculture-related positions.

Labor Supply--new graduates of higher education programs who are qualified for and are seeking employment in food- and agriculture-related positions.

Labor Demand--employment opportunities (job openings) related to food and agriculture created by industry growth and employee separations from the labor force due to death, disability, retirement, or personal reasons.

Purpose of Report

If the United States is to continue as the lead Nation in confronting problems associated with increasing global population and decreasing agricultural and natural resources, it must possess the requisite "human capital"--individuals with higher education in the food and agricultural sciences.

As colleges and universities strive to produce sufficient expertise in the food and agricultural sciences, they must have access to sound information for educational planning. One such information base denotes current and projected numbers of graduates of the specializations comprising the food and agricultural sciences. A second information base depicts the occupations which require higher education in food and agriculture, as well as current and projected levels of employment by occupational field. A synthesis of such information can then serve as a frame of reference for--

1. Identifying those academic areas which appear to warrant increased attention/support on the basis of stable or expanding employment opportunities which exceed qualified graduates.

2. Identifying those academic areas which are producing an adequate number of graduates to complement stable or declining labor market requirements.

Methodology

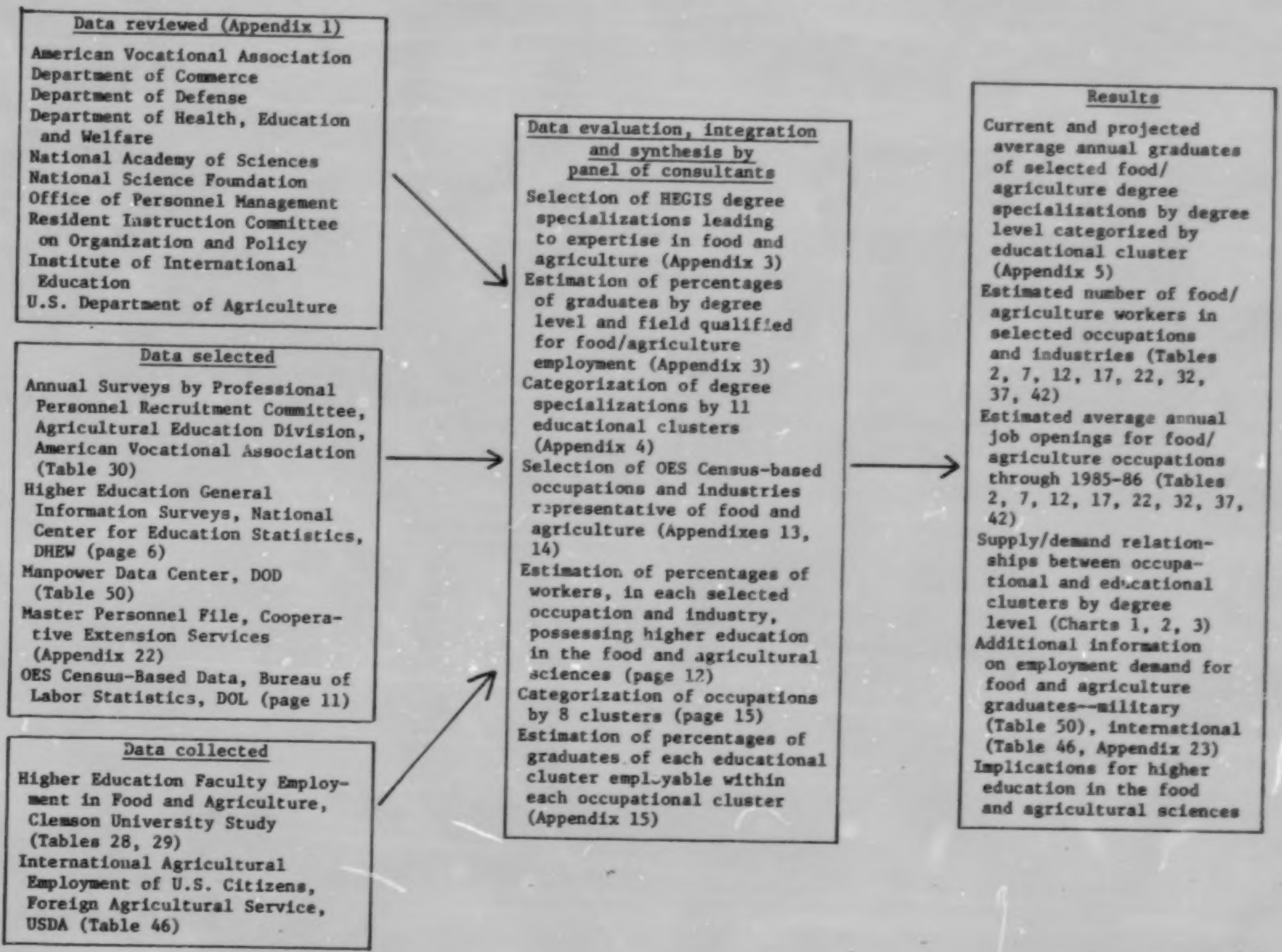
Overview

The methodology used for this study entailed a quantitative assessment of the supply of and demand for new graduates qualified for employment related to food and agriculture. The outline on page 3 summarizes the overall project design. The outline addresses the review of existing data bases, the selection of appropriate data bases, and the collection of new data. In addition, the outline denotes the manner in which expert opinion was used to synthesize the various data into a single analytic model.

Assumptions

Current as well as projected supply/demand estimates were developed. The projected estimates were predicated on the following basic assumptions:

Outline of the selection, evaluation, and interpretation of data relating supply of and demand for Food and Agriculture graduates



Data reviewed (Appendix 1)

American Vocational Association
Department of Commerce
Department of Defense
Department of Health, Education and Welfare
National Academy of Sciences
National Science Foundation
Office of Personnel Management
Resident Instruction Committee on Organization and Policy
Institute of International Education
U.S. Department of Agriculture

Data selected

Annual Surveys by Professional Personnel Recruitment Committee, Agricultural Education Division, American Vocational Association (Table 30)
Higher Education General Information Surveys, National Center for Education Statistics, DHEW (page 6)
Manpower Data Center, DOD (Table 50)
Master Personnel File, Cooperative Extension Services (Appendix 22)
OES Census-Based Data, Bureau of Labor Statistics, DOL (page 11)

Data collected

Higher Education Faculty Employment in Food and Agriculture, Clemson University Study (Tables 28, 29)
International Agricultural Employment of U.S. Citizens, Foreign Agricultural Service, USDA (Table 46)

Data evaluation, integration and synthesis by panel of consultants

Selection of HEGIS degree specializations leading to expertise in food and agriculture (Appendix 3)
Estimation of percentages of graduates by degree level and field qualified for food/agriculture employment (Appendix 3)
Categorization of degree specializations by 11 educational clusters (Appendix 4)
Selection of OES Census-based occupations and industries representative of food and agriculture (Appendixes 13, 14)
Estimation of percentages of workers, in each selected occupation and industry, possessing higher education in the food and agricultural sciences (page 12)
Categorization of occupations by 8 clusters (page 15)
Estimation of percentages of graduates of each educational cluster employable within each occupational cluster (Appendix 15)

Results

Current and projected average annual graduates of selected food/agriculture degree specializations by degree level categorized by educational cluster (Appendix 5)
Estimated number of food/agriculture workers in selected occupations and industries (Tables 2, 7, 12, 17, 22, 32, 37, 42)
Estimated average annual job openings for food/agriculture occupations through 1985-86 (Tables 2, 7, 12, 17, 22, 32, 37, 42)
Supply/demand relationships between occupational and educational clusters by degree level (Charts 1, 2, 3)
Additional information on employment demand for food and agriculture graduates--military (Table 50), international (Table 46, Appendix 23)
Implications for higher education in the food and agricultural sciences

1. Assumptions for projecting the 1985-86 supply of graduates of higher education in the food and agricultural sciences as developed by the National Center for Education Statistics, U.S. Department of Education (formerly part of the U.S. Department of Health, Education, and Welfare).

   a. Trends in graduation rates will not change drastically from the mid-1970's to the projected period in spite of a decline in the college age population and the propensity of older age groups to participate in the education process. Graduation rates may begin to decline toward the end of the decade.

   b. Values placed on an education will not alter significantly during the projected period.

   c. The proportion of graduates in a given degree specialization to the total number of graduates in the food and agricultural sciences may not remain constant through the projected period.

2. Assumptions for projecting the average annual demand through 1985 for graduates of higher education in the food and agricultural sciences as developed by the Bureau of Labor Statistics, Department of Labor.

   a. The institutional framework of the U.S. economy will not change radically through the projected period.

   b. Current sociological, technological, and scientific trends will continue through the projected period, including values placed on work, education, income, and leisure.

   c. The economy should gradually recover from the higher unemployment levels of the mid-1970's and reach full employment (defined as an unemployment rate of 4 percent) by the mid-1980's.

   d. No major event such as widespread or long-lasting energy shortages or war will significantly alter the industrial structure of the economy or alter the rate of economic growth by the mid-1980's.

   e. Trends in the occupational structure of industries will not be altered radically by changes in relative wages, technology, or other factors.

Some of the stated basic assumptions underlining the study may appear to be questionable in light of current developments. Because the primary data bases utilized in the project reflect such assumptions, the findings of the study pertaining to projected labor supply/demand should be interpreted accordingly.

Sources of Data

To the maximum extent possible, the project utilized existing data bases available through agencies of the Federal Government. Information on the supply of higher education graduates was obtained principally from the Higher Education General Information Surveys (HEGIS), a series of annual and periodic data collection instruments administered by the National Center for Education Statistics. The particular data collection component of HEGIS used was the survey of "Earned Degrees and Other Formal Awards Conferred." This survey collects information on the number of degrees conferred by degree specialization from each institution of higher education and is the most comprehensive source of data covering the output of higher education programs.

Occupational demand information pertaining to potential employment opportunities was obtained through the Occupational Employment Statistics (OES) Program of the Bureau of Labor Statistics (BLS). One of the components of OES is referred to as the Industry-Occupation (I-O) Census-Based Matrix. In addition to the decennial Census, the matrix data are based on many sources including BLS's Current Employment Statistics program and Current Population Survey program. The matrix provides employment data cross-classified by industry and occupation and is developed for a base year (current year) and for a projection year. Along with occupational rates for job separations because of death, retirements, and other factors, the employment matrices are used to estimate average annual job openings by occupation.

In addition to the HEGIS degrees conferred survey and the OES Industry-Occupation matrix, several other sources of information were utilized in the project.[1] Although not necessarily consistent with either of the core sources of data in terms of academic degree specialty or occupational concept, these other sources provided valuable information for the project. Appendix 1 summarizes these supplementary data bases and the manner in which they were utilized. As shown in Appendix 1, two special surveys were conducted--one, by Clemson University, encompassing faculty employment in the food and agricultural sciences in higher education institutions, and the other, by the Foreign Agricultural Service, USDA, covering international agricultural employment opportunities for Americans. These special surveys were conducted to provide information in areas where critical gaps in the existing data were identified.

Panel of Experts

Synthesizing the data from the various sources of information into a single analytic model was constrained because of (1) significant differences in the various occupational and educational taxonomies used to classify data from the individual sources, and (2) the limited set of data pertaining directly to the food- and agricultural-related labor market. To overcome these limitations, the use of expert opinion in assessing the relevance of information from a single source was a virtual necessity.

Throughout the project, a panel of consultants representing the Resident Instruction Section of the Division of Agriculture, National Association of State Universities and Land-Grant Colleges, provided suggestions and guidance for the study. Appendix 2 lists the members of the panel of consultants. Consensus from this panel of consultants was utilized in developing data for several aspects of the study, including:

1. Estimates of the percentage of graduates of the various academic degree fields qualified for employment in food- and agriculture-related occupations (Appendix 3). Estimates were developed based on available enrollment and degrees conferred statistics and knowledge of the curriculum associated with the various academic degree fields. Also, the estimates were based on the assumption that the percentages of graduates of the different degree

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[1] American Vocational Association, Department of Commerce, Department of Defense, Department of Health, Education and Welfare, National Academy of Sciences, National Science Foundation, Office of Personnel Management, Resident Instruction Committee on Organization and Policy of the National Association of State Universities and Land-Grant Colleges, Institute of International Education, U.S. Department of Agriculture.

fields qualified for food/agriculture employment would remain constant through the projected period.

2. Estimates of the percentage of employed workers in specific occupational fields within various industrial sectors that possess higher education in the food and agricultural sciences. Percentage estimates were based on analysis of current occupational employment data and knowledge of the skills and tasks required in each occupational field. Further, the percentage estimates were based on the assumption that the relative relationship of food and agriculture worker employment in an occupation to total employment in that occupation will remain constant through the projected period.

3. Estimates of the percentages of graduates of disciplines comprising the food and agricultural sciences distributed among defined occupational clusters. Appendix 15 provides the estimates derived from a synthesis of the various sources of education placement information described in Appendix 1.

In essence, the panel of consultants provided the necessary expertise to develop a single analytic model using several sources of data.

Identification of Supply of Higher Education Graduates Qualified for Food and Agricultural Occupations

The current supply of workers for a given occupation at a given point in time consists of persons currently employed in that occupation plus unemployed persons defined as available and actively seeking work in that occupation. In reality, the supply of workers for a specific occupation is not a static concept; rather, it is a dynamic one in which workers are continually moving into and out of the labor supply for a specific occupation. The projected supply of workers for a given occupation for a given future time period is the current occupational supply plus new entrants minus separations because of death, retirement, occupational transfer, or geographic migration. Expected new entrants for a given occupation may come from one of several sources, including:

- Unemployed persons
- Educational institution graduates
- Occupational transfers (if wage and/or nonmonetary inducements are offered)
- Geographic in-migrants
- Labor force new entrants or re-entrants

These sources of new entrants to the labor supply for a specific occupation are not mutually exclusive. For example, a graduate of an educational institution may relocate to a different geographic area (and, hence, be a geographic in-migrant). The graduate also may be a new entrant to the labor force. These concepts of labor supply for an occupation constrain efforts to develop an analytical model of the supply of qualified workers for defined occupational fields.

For the purposes of this project, labor supply was deemed to be new associate,[2] baccalaureate, master's, and doctoral graduates of higher education programs representative of the food and agricultural sciences who desire employment in food- and agriculture-related occupations. The following steps were used to assess the current and future supply of graduates:

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[2] Nontransferable associate degrees.

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1. Utilization of The Higher Education General Information Survey (HEGIS)

The Higher Education General Information Survey (HEGIS) was used to identify current (1976-77) and projected (1985-86) numbers of higher education graduates in the food and agricultural sciences. HEGIS is a series of annual and periodic surveys conducted by the National Center for Education Statistics (NCES), U.S. Department of Health, Education, and Welfare. HEGIS data are collected from all accredited public and private colleges and universities granting associate or higher degrees.[3] The results of this data collection process provide comprehensive figures classifying students of higher education degree programs by level of degree, discipline division, and degree specialization. Furthermore, graduates of each degree specialization are aggregated by sex. As of 1975, HEGIS initiated collection of racial and ethnic characteristics of graduates on a biennial basis.

The classifications of discipline divisions and degree specializations are presented in A Taxonomy of Instructional Programs in Higher Education, published by the National Center for Education Statistics. The HEGIS taxonomy classifies the degrees into two sections. Within Section I, conventional academic subdivisions of knowledge and training are contained which relate to the bachelor's degree level and higher. Section II contains technological and occupational specialties which relate to curricula leading to associate degrees and other awards below the baccalaureate.

These two sections are divided into discipline divisions which are divided further into degree specializations. As an example of the structure of the taxonomy, Agriculture and Natural Resources represents a Section I discipline division, while Poultry Science represents a degree specialization within this division. Natural Science Technologies represents a Section II technological specialty, while Agricultural Technologies represents a degree specialization within the Natural Science Technologies.

HEGIS has been producing data since the 1960's. Hence, an historical set of data exists. NCES uses these historical data to project future graduates of higher education.

2. Selection of Degrees Representative of the Food and Agricultural Sciences

While HEGIS provides a comprehensive, standard set of academic degrees data, not all of the graduates receiving the degrees are qualified for, nor desirous of, employment requiring expertise in the food and agricultural sciences. To determine relevant academic degrees, the panel of consultants was asked to identify the degree specializations that result in expertise in the food and agricultural sciences. The panel selected 122 HEGIS degrees for which all or some of the graduates were deemed qualified for jobs requiring food and agricultural expertise. For each of the degree specializations, the panel estimated also the percentage of graduates at each degree level (associate, baccalaureate, master's, doctoral) qualified for employment related to food/agriculture. Appendix 3 presents the degree specializations selected and percentages estimated by the panel.

Using both the agriculture degrees and the degrees related to agriculture, 11 educational clusters were defined for the purpose of aggregating the 122 degree specializations. The clusters group similar degree specializations according to educational emphases and are as follows:

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[3] Inclusive of junior colleges and community colleges.

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- General Agriculture (cluster 1)
- Agricultural Business and Management (2)
- Agricultural Engineering (3)
- Agricultural Related Sciences (4)
- Agricultural Social Sciences (5)
- Animal Sciences (6)
- Food Sciences (7)
- International Agriculture (8)
- Natural Resources (9)
- Plant Sciences (10)
- Soil Sciences (11)

For each of the 11 educational clusters, degree specializations were assigned to either an agriculture or an agriculture-related component of the cluster. Appendix 4 summarizes the assignment of HEGIS degrees to educational clusters. In certain instances, a HEGIS degree provides graduates for multiple educational clusters. Recipients of such degrees were prorated among the appropriate educational clusters. For example, 60 percent of Agronomy degrees were included in the Plant Sciences cluster, 40 percent of Agronomy degrees were included in the Soil Sciences cluster.

Subsequent to defining the educational clusters, data from 1976-77 HEGIS tabulations were aggregated accordingly. These data aggregations are presented in Appendix 5 by degree level, sex of student, and type of institution (for example, land-grant, nonland-grant). Appendix 5 is organized as follows:

- Associate Agriculture Degrees
- Associate Agriculture-Related Degrees
- Baccalaureate Agriculture Degrees
- Baccalaureate Agriculture-Related Degrees
- Master's Agriculture Degrees
- Master's Agriculture-Related Degrees
- Doctoral Agriculture Degrees
- Doctoral Agriculture-Related Degrees
- Doctor of Veterinary Medicine Degrees

Appendix 6 presents an overall summary of the supply of 1976-77 graduates by educational cluster deemed qualified for employment opportunities in food and agriculture.

3. Adjustment of HEGIS Data to Accommodate Allocation of General Degrees to Degree Specializations

Each of the major discipline divisions in the HEGIS taxonomy includes a degree specialization designated as general. The consensus of the panel of consultants was that students reported as recipients of a general degree frequently are qualified in a more specific discipline specialization. To adjust HEGIS data to more accurately reflect the actual specializations for which degrees were conferred, the panel of consultants estimated the percentage of such degrees which were in reality generalist degrees. The remainder of the general degrees were distributed across the specific degree specializations within the appropriate discipline divisions.

As an example of this procedure, reference is made to the Agriculture and Natural Resources academic discipline division of the HEGIS taxonomy. The panel of consultants determined that 5 percent of the baccalaureate degrees, 2 percent of the master's degrees, and none of the doctorates conferred as General Agriculture (0101) were legitimate generalist degrees. The remaining degrees conferred as General Agriculture were distributed proportionately among the other degree specializations within the Agriculture and National Resources discipline division, excluding Forestry, which is considered to be a specialized degree rarely recorded erroneously as a degree in General Agriculture. Appendix 7 summarizes the percentage factors determined by the panel of consultants for the number of general degrees to be retained as legitimate general degrees.

4. Projections of Higher Education Graduates

In developing the 1985-86 projections of higher education graduates in the food and agricultural sciences qualified for employment in food/agriculture occupations, several procedures were followed. The initial procedure was the acquisition of HEGIS degree projections from the National Center for Education Statistics. These projections are available by level, sex, and field of study through an ongoing program at NCES.

Projections of degrees produced by NCES are based on the Earned Degrees Conferred reports from accredited institutions of higher education listed in the Education Directory. Although these reports provide a large portion of the data, additional data and information are supplied by education and professional associations, experts in the fields, and other agencies in the Federal Government.

NCES uses a College Graduate Model (CGM) which produces projections of the supply of college graduates at the bachelor's, master's, and doctor's levels. For each sex, the College Graduate Model maintains a data bank of historical time series of earned degrees conferred by level and field of study. In addition, projections of other variables (social, demographic, and economic) are internal to the model.

The supply of college graduates comes from two submodels of CGM. Specifically, the projections of degrees by level and sex are produced by the Level and Sex Submodel (LSS) and projections of degrees by field of study are produced by the Degrees by Field Submodel (DFS).

Beginning with enrollment projections by type of student based on population and enrollment projections developed by the Bureau of the Census, the projections of total degrees by level and sex are developed using enrollment rates and age-specific graduation rates. Specifically, projections of bachelor's degrees are produced by projecting enrollment rates by attendance status of fourth-year college enrollment to undergraduate college enrollment. The projections of master's degrees are developed by projecting enrollment rates by attendance status of first-year graduate college enrollment to total graduate college enrollment. The age-specific projections of doctor's degrees are based jointly on the projections of enrollment rates of sixth-year college enrollment and enrollment beyond the sixth year.

Projections of these enrollment rates at the bachelor's, master's, and doctor's levels and the projections of graduation rates at the doctor's level are primarily based on the assumption that the prevailing past trends will continue into the future. Exponential smoothing is the principal projection method used to project the enrollment and graduation rates.

The NCES projections of degrees by 20 major fields are developed analyzing historical time series of earned degrees by sex. When available, additional variables are incorporated into the final equations. Principal projection methods include exponential smoothing and regression analysis. Final degree projections by field are obtained by comparing the sum of the field projections by level to total degrees by level. The two sets of projections are adjusted iteratively until general consistency is obtained.

For the purposes of this project, the numbers of graduates projected by NCES were used as control totals. Basically, these projections were for broad discipline divisions.[4] Therefore, since NCES did not provide projections of graduates by detailed degree specialization, these projections had to be developed for the project. For this development, historical data were acquired from NCES for each degree specialization by level and by sex. Since the projections of graduates were needed for the total of both sexes, the male and female historical data were summed by degree specialty. With the resulting series, extrapolative techniques were generally used to develop the projected values.

In addition, degree specializations which represented a relatively large share of a control group were directly tied to the group's growth rate. Degree projections from other sources, expected labor market conditions, and projected demographic characteristics were also considered in the development of the degree projections. The sums of the generated individual projections by degree specialization were compared to the NCES broad group totals. When differences occurred, the specializations were forced to the NCES control totals.

The projections of graduates for the general degrees were distributed across the relevant individual degree specializations according to the same procedures established for the analyses of historical HEGIS data. A comparison of current and projected estimates of graduates in the food and agricultural sciences is presented in Appendix 8. The estimates are aggregated according to the 11 educational clusters utilized in the project.

5. Processing of Current and Historical HEGIS Data

The HEGIS public distribution tapes were acquired from NCES for each academic year, 1970-71 through 1977-78. For each academic year, tabulations of degrees conferred were generated and are on file in the Office of Higher Education, SEA, USDA by:

degree level

- associate
- baccalaureate
- master's
- doctorate
- first professional degree

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[4] It is not the practice of NCES to project the number of graduates by specific degree areas, because the reliability of the results cannot be substantiated.

sex of student

- male
- female

type of institution

- land-grant colleges of 1862
- land-grant colleges of 1890 and Tuskegee Institute
- all land-grant institutions
- all nonland-grant institutions

For purposes of brevity, this report presents information pertaining only to degrees conferred in 1976-77 by all institutions.[5] It is recommended that future reports address sex, race, and ethnicity of graduates, as well as institutional type (e.g., land-grant, nonland-grant).

Development of Data on the Demand for Food and Agriculture Graduates

A comprehensive data base does not exist specific to the full spectrum of employment in food and agricultural occupations. Therefore, this project employed an innovative, experimental methodology to develop estimates of the number of workers by occupation that require higher education in the food and agricultural sciences.[6] The major source of employment data used was the Occupational Employment Statistics (OES) Program of the Bureau of Labor Statistics. The following discussion provides an overview of the process used to develop a major portion of the occupational demand data for this project.

1. Occupational Employment Statistics (OES) Program

The OES Program is a Federal/State cooperative statistical program of the U.S. Department of Labor and is comprised of three components, as follows:

(a) Survey Component -- The OES survey collects employment figures by occupation from nonfarm establishments with the objective of providing current, reliable, and detailed occupational employment data. The survey is conducted by the State Employment Security Agencies over a 3-year cycle with different industries surveyed each of the 3 years. The survey instrument used is specific to each industry surveyed.

(b) Industry-Occupation Matrix Component -- The national matrix system produces tabular presentations of current and projected employment statistics cross-classified by industry and occupation. These national tables or matrices are currently based on the 1970 Census of Population concepts and classification systems. In the future, matrices will be based on the OES survey classification system. With data from a base year matrix, a projected year matrix, and with job separation rates developed from decennial Census data and working life tables, the matrix system can generate future job openings for occupations. The national matrices have been used as tools for policy decisions as well as aids to develop State and area occupational employment projections.

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[5] The 1977-78 HEGIS tape became available January 1980. Time did not allow incorporating the data in this report.

[6] Future replications of the study should serve to accommodate refinement and validation of the research design.

(c) State and Area Projections Program Component -- This program produces current and projected employment statistics cross-classified by industry and occupation for all States, many metropolitan cities, and other labor market areas. The matrices may be based on the OES Survey or OES Census classification systems. The matrix data, adjusted for job separation rates due to death and retirement, yields estimated job openings by occupational field.

2. OES Survey-Based Matrix/OES Census-Based Matrix

Initially, the project consultants selected, as the primary source of employment estimates, the matrix that is being developed from OES survey occupations and industries, rather than the matrix based upon OES Census occupations and industries. This decision was made because the OES survey matrix provides for greater specificity. For example, a Census industry can be comprised of multiple survey industries. Likewise, a Census occupation can be an aggregate of numerous survey occupations. Specific examples are as follows:

This OES Census Industry aggregates these OES Survey Industries

• metal mining	• iron ores
	• copper ores
	• lead and zinc ores
	• bauxite and other aluminum ores
	• miscellaneous metal ores

This OES Census Occupation aggregates these OES Survey Occupations

• accountants	• accountants and auditors
	• tax examiners, collectors, and/or revenue agents
	• tax preparers

After the project was initiated, it was learned that the OES survey-based matrix would not be available until late 1980. This required a conversion of project design to facilitate use of the OES Census-based matrix.

3. Computation of Demand Data

The following steps were taken in developing data on the demand for food and agriculture graduates:

a. Selection of OES Survey Occupations

The consultants reviewed a complete listing of OES survey occupations. From this list they selected those occupations perceived as likely to require formal training in food and agriculture. The list of selected OES occupations is presented in Appendix 9.

b. Selection of OES Survey Industries

The consultants also reviewed a complete listing of OES survey industries and selected those industries likely to employ persons with food or agricultural training. The list of selected OES survey industries is presented in Appendix 10.

c. Development of Industry-Occupation (I-O) Matrix

The industries and occupations selected by the consultants were arranged in a matrix format. All selected occupations were listed under each selected industry. An example of an I-O matrix is presented in Appendix 11.

d. Estimation of Percentage of Workers Likely To Possess Food or Agricultural Training

For each industry, the consultants examined the number of workers employed in each occupation and estimated the percentage deemed to possess food or agricultural training. For example, it was estimated that 10 percent of the agricultural and biological technicians in the dairy products industry possess food or agricultural training.

4. Conversion From OES Survey-Based to OES Census-Based Industry-Occupation Matrix

Subsequent to completion of an OES survey industry-occupation matrix, a decision was made to convert to an OES Census-based matrix. The conversion process was complex. Cross-coding systems, which relate survey data to Census data, were used to create the Census-based matrix. The percentage of workers deemed to possess food or agricultural training was adjusted to reflect the distribution of survey industries and occupations included within a Census-based matrix cell. A simplified example of the conversion process is presented in Appendix 12. Appendixes 13 and 14, respectively, present the final list of Census occupations and industries used in the project.

a. Multiplication of Percentage of Workers That Possess Food or Agricultural Training by Current and Projected Occupational Employment

Occupational employment for 1976 was used as the base year for the project. The percentages of workers estimated to possess food or agricultural training were multiplied by the 1976 and 1985 employment levels.

b. Calculation of Total Workers in an Occupation Who Possess Food or Agricultural Training

The number of persons in an occupation perceived as possessing food or agricultural training was determined by summing employment for a given occupation across all selected industries. The following example depicts the process:

1976 estimated number of workers with food or agricultural training

	OES census industry A	OES census industry B	OES census industry C	OES census industry D	OES census industry E	Total (all selected industries)[1]
OES census occupation	10	5	0	2	31	48

[1] The total number of persons in the occupation who possess food or agricultural training equals 48. This calculation represents the sum of all workers across industries A-E.

The process diagrammed was carried out for 1976 and 1985 employment levels. Therefore, for each occupation used in the project, data are available on the number of persons employed in 1976 and the number of persons expected to be employed in 1985 estimated as possessing food or agricultural training.

c. Calculation of Average Annual Employment Growth

The average annual employment growth was calculated by dividing the total growth by the number of years in the period. For example, 1976 employment for dietitians was 45,790 and 1985 projected employment is 51,997; therefore, the total growth is 51,997 minus 45,790 or 6,207. Since there are 9 years in the period, the average annual growth is 6,207 divided by 9, or 690.

d. Calculation of Average Annual Replacements

Employment opportunities are created when currently employed persons leave their jobs. The Bureau of Labor Statistics has devised a methodology to estimate the number of employee replacement opportunities that will be created as a result of employee deaths, retirements, disabilities, or temporary withdrawals from the labor force for personal reasons. The methodology uses decennial Census data on the age and sex distribution of workers in an occupation and working-life tables. These data are used to calculate separation rates. The manner in which separation rates are used is shown in the following diagram.

OES census occupation	Estimated workers with food/agricultural training				
	1976	1985	Mid-year separation rate	Mid-year employment[1]	Average replacements[2]
Dietitian	45,790	51,997	.0424	48,894	2,073

1. 1976 employment (45,790) plus 1985 employment (51,997) divided by 2 = 48,894.
2. Mid-year separation rate multiplied by mid-year employment.

e. Calculation of Average Annual Openings

The total average annual openings in an occupation for persons with food or agricultural training was calculated by adding average annual growth and average annual replacements. An example is presented below.

Census occupation	Average annual estimates		
	Growth	Replacements	Openings (Total)
Dietitian	690	2,073	2,763

5. Aggregation of Demand Data Into Occupational Clusters

For organizational purposes, the 83 occupations used were apportioned among 8 occupational clusters established by the panel of consultants. These occupational clusters are as follows:

- Scientific and Professional Specialists (cluster 1)
- Manufacturing and Processing Scientists and Engineers (2)
- Sales and Service Representatives and Purchasing Agents (3)
- Administrators, Managers, and Financial Advisors (4)
- Educators (5)
- Media Specialists (6)
- Agricultural Production and Management Specialists (7)
- Miscellaneous Agricultural Specialists (8)

Analysis of Supply/Demand Relationships

One of the most important components of this particular study was the specification of relationships between educational programs and occupations. The relationships between degree areas and occupational employment are complex for higher education graduates. Furthermore, little empirical information exists relative to specific placement of higher education graduates in the food and agricultural sciences.

Placement studies which collect data on the employment of graduates provide an empirical basis for specifying relationships between degree areas and occupations. The project consultants examined data from a variety of placement studies. This review, synthesized with professional expertise, enabled the consultants to relate degrees to occupations via a matrix format. The consultants then estimated the percentage of graduates from each designated educational cluster qualified for employment in each occupational cluster designated for the project. Further, estimates were determined for the percentage of graduates in each educational cluster that would elect not to enter the labor force.

The percentage distributions of graduates of educational clusters to occupational clusters established for the project are presented in Appendix 15. The Appendix displays the percentage distributions for each degree level (associate, baccalaureate, master's, and doctorate). These percentage distributions were multiplied by the number of persons graduating in 1976-77 in each of the educational clusters, respectively, for agriculture degrees and for agriculture-related degrees.

Appendix 16 presents the actual computations for graduates with food and agriculture degrees that were estimated to be employed in food and agriculture occupations. Appendix 17 presents similar computations for graduates receiving degrees related to agriculture. The total supply of graduates with agriculture degrees and with agriculture-related degrees, as distributed by occupational cluster, is shown in Appendix 18. Appendixes 19-21 present similar computations for projected 1985-86 graduates of higher education in the food and agricultural sciences.

Summary

Financial and temporal constraints dictated that the study utilize existing data bases to the maximum extent possible. In order to assess the relevance of the available data bases and to develop a framework for synthesizing the data into a single analytical model, a panel of consultants was established. This panel provided guidance and direction throughout the entire project.

In addition to using existing data, the study entailed the collection and use of two new data bases. One such data base, developed by Clemson University with USDA-SEA support, identifies current and projected employment of faculty in higher education in the food and agricultural sciences. A second data base, developed explicitly for the study via cooperation with the USDA Foreign Agricultural Service, represents an initial attempt to gain insight into international employment opportunities for American graduates in the food and agricultural sciences.

As outlined on page 3, the following procedures were employed in conducting the study:

1. Procedures for identifying supply of higher education graduates in the food and agricultural sciences
    a. Selection from the HEGIS taxonomy of agriculture and agriculture-related degree specializations leading to expertise in food and agriculture.

b. Identification of degrees for which 100 percent of the graduates are deemed qualified for employment in food and agriculture positions.

c. Estimation of specific percentages, by degree level, of graduates of the remaining degrees deemed qualified for employment in food and agriculture positions.

d. Computation of actual numbers of graduates with agriculture or agriculture-related degrees based on 1976-77 HEGIS earned degrees conferred data.

e. Assignment of selected HEGIS agriculture and agriculture-related degrees to 11 educational clusters established for organizational purposes of the study: When HEGIS degree specializations appeared to produce graduates related to more than one educational cluster, graduates were prorated among the appropriate clusters.

2. Procedures for assessing employment demand for graduates of higher education in the food and agricultural sciences

   a. Identification of OES-survey based industries and occupations representative of the full spectrum of employment related to food and agriculture.

   b. Estimation of the percentage of workers, in each selected occupation for each selected industry, deemed to possess higher education in the food and agricultural sciences.

   c. Conversion to OES Census-based data to facilitate completion of the project within the established time frame.

   d. Computation of current occupational employment and projected average annual openings.

   e. Assignment of selected occupations to eight occupational clusters established specifically for organizational purposes of the study.

3. Procedures for relating supply to demand

   a. Estimation of the percentage of graduates representative of each educational cluster electing not to enter the food and agricultural labor force--return to native country, continue education, elect career in unrelated field, etc.

   b. Estimation of the percentage of graduates of each educational cluster obtaining employment within each occupational cluster.

   c. Computation of supply/demand figures.

   d. Analysis of supply/demand relationships.

The project represents the first phase of a continuing effort to conduct a comprehensive supply/demand analysis of graduates of higher education in the food and agricultural sciences. Of necessity, innovative and experimental methodologies were employed. Future replications of the project should accommodate further refinement and validation of these methodologies, thereby resulting in enhanced specificity and reliability of findings.

CHAPTER II

Introduction to Findings

Future growth of agricultural productivity and increases in production, distribution, and consumption efficiency require a continuing supply of qualified food and agricultural workers. Traditionally, institutions of higher education have been expected to supply the requisite number of graduates qualified to assume professional roles entailing high levels of expertise in food and agriculture.

In recent years, many developments have appeared to substantiate the contention that the Nation may well be facing a shortage of qualified expertise in the food and agricultural sciences. Representatives of industry, government, and higher education frequently cite significant difficulty in employing specific types of professionals in food and agriculture. College and university educators continually project decreasing enrollments and graduations in the food and agricultural sciences. Furthermore, technological advancements, diminishing natural resources, and an increasing global population are introducing changes throughout the structure of the food and agricultural labor force.

Concern for assessing the extent to which higher education is producing sufficient expertise to enable the U.S. to maintain its status as the lead Nation in confronting food and agricultural issues prompted this study. Essentially, the study was undertaken to achieve the following major objectives:

1. identification of the current and future supply of graduates of higher education in the food and agricultural sciences

2. identification of the current and future employment demand for graduates of higher education in the food and agricultural sciences

3. analysis and interpretation of supply/demand relationships.

Presentation of Findings

Estimates for national supply of and demand for higher education graduates in the food and agriculture sciences are organized and presented for eight occupational clusters. The following information is included for each cluster:

- Description of the occupational cluster
- Summary and detailed data on the supply of agriculture graduates and agriculture-related graduates qualified for employment in the occupations within the cluster
- Summary and detailed employment demand data for each occupation within the cluster
- Selected examples of specific food and agriculture jobs included in the occupations in the cluster
- Narrative interpretation of employment opportunities for food and agriculture graduates

The presentation of findings for the occupational cluster, Educators, differs in format. Data on employment opportunities in the education field were obtained from several sources in addition to BLS. These sources included SEA-Extension, the Agricultural Education Division of the American Vocational Association, and the Clemson University Survey of Students and Faculty in Higher Education in the Food and Agricultural Sciences.

Scientific and Professional Specialists
(Occupational Cluster #1)

Included in this cluster are the professional occupations that involve high levels of technical agricultural and scientific competency. These occupations generally require the application of mathematics, biology, chemistry, statistics, or the social sciences to solving problems, expanding productivity, or increasing efficiency in the areas of food, agriculture, and renewable natural resources.

Table 1--Supply of Agriculture graduates qualified for employment as Scientific and Professional Specialists[1]

	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
Current, 1976-77	7,652	1,133	384	1,142	10,311
Projected, 1985-86	8,737	1,390	461	1,440	12,028
Average annual, 1976-86	8,194	1,262	423	1,291	11,170
Supply of Agriculture-related graduates:					
Current, 1976-77	1,943	364	170	--	2,477
Projected, 1985-86	2,123	440	178	--	2,741
Average annual, 1976-86	2,033	402	174	--	2,609

1. Estimates represent summations of data in Tables 3 and 4.

Table 2--Employment demand for Scientific and Professional Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Agricultural scientists	20,396	100.0	1,304
Agricultural and biological technicians (except health)	24,192	56.0	850
Architects (landscape)[4]	13,000	100.0	944
Atmospheric and space scientists	1,466	13.0	24
Chemical technicians	2,012	2.4	17
Chemists	12,526	10.0	1,058
Clinical lab technicians/technologists	5,867	3.0	470
Computer programmers	1,446	.6	115
Computer systems analysts	1,206	.9	57
Dietitians	45,790	100.0	2,763
Foresters and conservationists	49,187	100.0	2,082
Geologists	743	2.0	36
Health aides (except nursing)	6,664	2.9	738
Health technicians/technologists, nec[5]	7,959	7.0	365
Inspectors, public administration (except construction)	22,793	20.0	1,533
Life and physical scientists, nec	252	11.4	6
Marine scientists	600	8.4	26
Recreation workers	9,449	7.7	538
Social workers	3,679	1.1	292
Sociologists	33	.8	3
Statisticians	831	3.4	32
Surveyors	1,929	3.6	85
Urban and regional planners	2,292	14.1	200
Veterinarians	24,693	100.0	1,448
Total	259,005		14,986

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1. Based on OES Census-based data; detailed data are shown in Table 5.
2. Number of workers estimated as possessing higher education in food/agriculture.
3. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.
4. Source: Occupational Projections and Training Needs. Bulletin 2020, Bureau of Labor Statistics, U.S. Department of Labor, 1979.
5. nec = not elsewhere classified.

Table 3--1976-77 supply of graduates qualified for employment as Scientific and Professional Specialists[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
Agricultural Business and Management	180	134	44	--	358
Agricultural Engineering	151	20	3	--	174
Agricultural Social Sciences	170	--	5	--	175
Animal Sciences	399	91	61	1,142	1,693
Food Sciences	2,732	415	47	--	3,194
Natural Resources	3,457	278	87	--	3,822
Plant Sciences	327	132	90	--	549
Soil Sciences	236	63	47	--	346
Total	7,652	1,133	384	1,142	10,311
Supply of Agriculture-related graduates:					
Agricultural Business and Management	362	217	10	--	589
Agricultural Engineering	57	16	--	--	73
Agricultural Related Sciences	1,152	64	67	--	1,283
Agricultural Social Sciences	103	0	2	--	105
Animal Sciences	103	39	72	--	214
Food Sciences	52	6	1	--	59
Natural Resources	100	12	7	--	119
Plant Sciences	12	9	11	--	32
Soil Sciences	2	1	--	--	3
Total	1,943	364	170	--	2,477

[1] Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 4--1985-86 projected supply of graduates qualified for employment as Scientific and Professional Specialists[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
Agricultural Business and Management	216	172	56	--	444
Agricultural Engineering	240	28	7	--	275
Agricultural Social Sciences	170	--	3	--	173
Animal Sciences	500	128	70	1,440	2,138
Food Sciences	2,541	477	51	--	3,069
Natural Resources	4,306	337	110	--	4,753
Plant Sciences	453	166	104	--	723
Soil Sciences	311	82	60	--	453
Total	8,737	1,390	461	1,440	12,028
Supply of Agriculture-related graduates:					
Agricultural Business and Management	416	263	19	--	698
Agricultural Engineering	132	25	1	--	158
Agricultural Related Sciences	1,185	72	64	--	1,321
Agricultural Social Sciences	115	--	3	--	118
Animal Sciences	94	50	71	--	21
Food Sciences	52	6	1	--	59
Natural Resources	113	14	8	--	135
Plant Sciences	14	9	10	--	33
Soil Sciences	2	1	1	--	4
Total	2,123	440	178	--	2,741

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1. Based upon NCES projections as adjusted for the project.

Table 5--Detailed employment demand data for Scientific and Professional Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Agricultural scientists	042	20,396	25,997	100.0	100.0	5,601	622	682	1,304
Agricultural and biological technicians (except health)	150	24,192	26,226	56.0	57.0	2,034	226	624	850
Architects (landscape)[2]	002	13,000	17,000	100.0	100.0	4,000	444	500	944
Atmospheric and space scientists	043	1,466	1,414	13.0	11.8	<52>	<6>	30	24
Chemical technicians	151	2,012	1,884	2.4	2.0	<128>	<14>	31	17
Chemists	045	12,526	15,099	10.0	10.0	2,573	285	773	1,058
Clinical lab technologists/ technicians	080	5,867	8,376	3.0	3.0	2,509	279	191	470
Computer programmers	003	1,446	1,836	.6	.6	390	43	72	115
Computer systems analysts	004	1,206	1,589	.9	.9	383	43	14	57
Dietitians	074	45,790	51,997	100.0	100.0	6,207	690	2,073	2,763
Foresters and Conservationists	025	49,187	56,299	100.0	100.0	7,112	790	1,292	2,082
Geologists	051	743	925	2.0	1.7	182	20	16	36
Health aides (except nursing)	922	6,664	10,593	2.9	3.0	3,929	437	301	738
Health technicians/ technologists, nec	085	7,959	9,252	7.0	6.8	1,293	144	221	365
Inspectors, public administration (except construction)	215	22,793	28,998	20.0	20.0	6,205	689	844	1,533
Life and physical scientists, nec	054	252	262	11.4	9.0	10	1	5	6
Marine scientists	052	600	717	8.4	8.0	117	13	13	26
Recreation workers	101	9,449	11,720	7.7	8.0	2,271	252	286	538
Social workers	100	3,679	5,027	1.1	1.2	1,348	150	142	292
Sociologists	094	33	49	.08	1.2	16	2	1	3
Statisticians	036	831	877	3.4	2.9	46	5	27	32
Surveyors	161	1,929	2,358	3.6	3.2	429	48	37	85

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1. Developed from OES national Census-based matrix data.
2. Source: Occupational Projections and Training Needs. Bulletin 2020, Bureau of Labor Statistics, Department of Labor, 1979.

Table 5--Detailed employment demand data for Scientific and Professional Specialists with higher education in the food and agricultural sciences[1]--Continued

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Urban and regional planners	095	2,292	3,673	14.1	16.0	1,381	153	47	200
Veterinarians	072	24,693	31,897	100.0	100.0	7,204	800	648	1,448

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1. Developed from OES national Census-based matrix data.
2. Source: Occupational Projections and Training Needs. Bulletin 2020, Bureau of Labor Statistics, Department of Labor, 1979.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Scientific and Professional Specialists

The Census occupations used in the project to assess demand for graduates of higher education in the food and agricultural sciences frequently serve as aggregations of more specific job titles. The 1971 Classified Index of Industries and Occupations, published by the Bureau of the Census, U.S. Department of Commerce, provides an exhaustive listing of the specific job titles comprising each aggregate Census occupation.

The following listing is intended to illustrate some of the specific job titles as aggregated by some of the Census occupations included in the cluster for scientific and professional specialists. Similar lists will be provided for the Census occupations included in six of the remaining seven occupational clusters. The occupational cluster for Educators is self-explanatory.

1970 Census-of-population code	Census occupation	Examples of specific jobs
042	Agricultural scientist	Agricultural consultant Agricultural scientist Agriculturist Agronomist Animal breeder Animal pathologist Arborist Dairy scientist Dairy technologist Floriculturist Forest pathologist Plant breeder Wool technologist
150	Agriculture and biological technician (except health)	Artificial breeder Agricultural research laboratory assistant Botany laboratory assistant Breeding technician Dairy and food laboratory assistant Research technician Seed analyst Seed laboratory assistant Seed specialist Silviculturist Wildlife technician
002	Architect	Landscape architect
043	Atmospheric and space scientist	Atmospheric scientist Weather analyst
151	Chemical technician	Chemical technician Fiber analyst Water analyst

1970 Census-of-population code	Census occupation	Examples of specific jobs
045	Chemist	Agricultural chemist
		Cereal chemist
		Dairy chemist
		Food analyst
		Food chemist
		Food scientist
		Food technologist
		Laboratory chemist
		Nutritional chemist
		Pesticide chemist
		Quality-control chemist
		Soil chemist
		Water chemist
080	Clinical-laboratory technologist/technician	Clinical laboratory technician
		Clinical laboratory technologist
		Hematology technician
		Hematology technologist
		Tissue technician
074	Dietitian	Consultant, dietitian
		Diet therapist
		Dietist
		Dietitian
		Food adviser
		Nutrition director
		Nutritionist
		Public health dietitian
		Research dietitian
025	Forester and conservationist	Conservationist
		District conservationist
		Fish conservationist
		Fish culturist
		Forest ecologist
		Forester
		Forest examiner
		Forest manager
		Forestry consultant
		Plant control aide
		Range conservationist
		Soil conservationist
		Soil surveyor
		Superintendent
		Supervisor
		Surveyor
		Type mapper
		Vector-control specialist
		Wood technologist
051	Geologist	Hydrogeologist
		Sedimentationist

1970 Census-of-population code	Census occupation	Examples of specific jobs
922	Health aide (except nursing)	Dietary aide Dietary worker Food service manager Nutrition aide Supervisor of food service
085	Health technologist/ technician, nec[1]	Animal technician Dietary technician Environmental-health technician Environmental-health technologist Food service technician Health sanitarian Veterinary technician Water pollution specialist
215	Inspector, public administration (except construction)	Cattle examiner Customs agent Dairy inspector Eggs inspector Food inspector Grain sampler Livestock inspector Marketing specialist Meat grader Plant quarantine inspector Tobacco grader Vegetable inspector
101	Recreation worker	Camp advisor Camp director
100	Social worker	Rural-health consultant
094	Sociologist	Rural sociologist
095	Urban and regional planner	Director of planning Regional planner
072	Veterinarian	Doctor of veterinary medicine Epidemiologist, veterinarian Laboratory veterinarian Poultry pathologist veterinarian Veterinary dentist Veterinary inspector Veterinary pathologist Veterinary radiologist Veterinary surgeon Veterinary toxicologist

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[1] nec = not elsewhere classified.

Interpretation of Employment Opportunities for Scientific and Professional Specialists

The summary supply and demand data for scientific and professional specialists as presented in Tables 1 and 2, respectively, suggest an inadequate average annual supply of qualified higher education graduates through 1985. There is a marked deficiency when only agriculture graduates are considered. However, the inclusion of graduates of agriculture-related fields fails also to satisfy the demand.

The average annual demand for 1,448 veterinarians, as shown in Table 2, refers only to private clinical practitioners. The average annual supply of 1,291 graduates satisfies 89 percent of this demand. While a report to the American Veterinary Medical Association by Arthur D. Little, Inc.,[7] projects an oversupply of veterinarians by the end of the decade, another study by the Health Resources Administration, DHEW,[8] projects shortages in the mid-decade. This study further suggests supply/demand balance for veterinarians may occur by the end of the decade.

Analysis of the remaining supply/demand data, excluding veterinarians, indicates that approximately 12,488 graduates will be available to fill 13,538 positions annually. Thus, the total average annual demand exceeds supply by 8 percent. There are no national employment demand data documenting degree type and level requisite to occupational employment. Therefore, it is not feasible to statistically relate the supply of graduates by degree level, as shown in Table 1, to the specific occupational employment data presented in Table 2. However, analysis of the total supply/demand for scientific and professional specialists indicates that the average annual supply of doctoral graduates meets 4 percent of the demand; master's graduates equal 12 percent; baccalaureate graduates equal 76 percent.

Public consciousness and national priorities for the 1980's reflect a concern for greater productivity in agriculture, more energy-efficient food production and delivery systems, and environmental quality, as well as a more nutritious and safer food supply. Therefore, a sustained and expanding demand for scientific and professional specialists in food and agriculture is anticipated for several decades. It is important to note that many such specialists must possess the highest level of expertise in the food and agricultural sciences. An adequate supply of such human capital capable of responding to national priorities and public concern related to food, agriculture, and natural resources is critical to national and world progress, perhaps even human survival.

Higher education in food and agriculture must be encouraged to attract and graduate more students in such disciplines as the following:

- Agricultural Engineering
- Animal Sciences
- Food Sciences
- Natural Resources (master's and doctoral levels)[9]
- Plant Sciences
- Soil Sciences

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[7] Veterinary Supply and Demand in the United States: A Report to the American Veterinary Medical Association. Arthur D. Little, Inc., 80559-07, 1978.

[8] Report to the President and Congress on the Status of Health Professions Personnel in the United States. Health Resources Administration, Department of Health, Education, and Welfare. HEW-HRA/78-93, 1978.

[9] The supply of graduates with baccalaureate degrees appears adequate to meet the employment demand for Scientific and Professional Specialists.

Manufacturing and Processing Scientists and Engineers[1] (Occupational Cluster #2)

Included in this occupational cluster are the scientific and engineering occupations related to the design of facilities, processing, and quality control of products manufactured from raw agricultural and forest inputs.

Table 6--Supply of Agriculture graduates qualified for employment as Manufacturing and Processing Scientists and Engineers[1]

	Associate[2]	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total[3]
Supply of Agriculture graduates:						
Current, 1976-77	44	2,771	655	120	167	3,757
Projected, 1985-86	NA	3,332	777	157	200	4,466
Average annual, 1976-86	NA	3,051	716	138	184	4,089
Supply of Agriculture-related graduates:						
Current, 1976-77	--	282	78	25	--	385
Projected, 1985-86	--	369	101	27	--	497
Average annual, 1976-86	--	326	90	26	--	442

1. Estimates represent summations of data in Tables 8 and 9.
2. Projections are not available (NA) for the associate degree level.
3. Associate degree recipients are included only in the "Current" total.

Table 7--Employment demand for Manufacturing and Processing Scientists and Engineers with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Biological scientists	10,404	20.0	663
Checkers, examiners, and inspectors (manufacturing)	7,350	1.1	533
Chemical engineers	484	.9	38
Civil engineers	3,692	2.3	186
Drafters	2,087	.6	72
Electrical and electronic engineers	18,925	6.2	773
Engineers, nec (agricultural engineers)[4,5]	12,000	7.4	633
Expeditors and product controllers	10,288	5.0	613
Graders and sorters (manufacturing)	4,875	11.0	230
Industrial engineers	9,250	5.0	518
Inspectors, scalers, and graders (log and lumber)	18,394	100.0	763
Mechanical engineers	12,218	6.0	522
Total	109,967		5,544

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1. Based on OES Census-based data; detailed data are shown in Table 10.
2. Number of workers estimated as possessing higher education in food/agriculture.
3. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.
4. Source: Occupational Projections and Training Needs. Bulletin 2020, Bureau of Labor Statistics, U.S. Department of Labor, 1979.
5. nec = not elsewhere classified.

Table 8--1976-77 supply of graduates qualified for employment as Manufacturing and Processing Scientists and Engineers[1]

Educational cluster	Associate	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:						
Agricultural Engineering	--	151	33	10	--	194
Animal Sciences	--	--	--	--	167	167
Food Sciences	44	546	414	72	--	1,076
Natural Resources	--	2,074	208	38	--	2,320
Total	44	2,771	655	120	167	3,757
Supply of Agriculture-related graduates:						
Agricultural Engineering	--	57	26	--	--	83
Food Sciences	--	11	6	--	--	17
Agricultural Related Sciences	--	154	37	22	--	213
Natural Resources	--	60	9	3	--	72
Total	--	282	78	25	--	385

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1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 9--1985-86 projected supply of graduates qualified for employment as Manufacturing and Processing Scientists and Engineers[1,2]

Educational cluster	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
Agricultural Engineering	240	47	31	--	318
Animal Sciences	--	--	--	200	200
Food Sciences	508	477	77	--	1,062
Natural Resources	2,584	253	49	--	2,886
Total	3,332	777	157	200	4,466
Supply of Agriculture-related graduates:					
Agricultural Engineering	132	42	2	--	176
Food Sciences	11	6	--	--	17
Agricultural Related Sciences	158	42	21	--	221
Natural Resources	68	11	4	--	83
Total	369	101	27	--	497

[1] Based upon NCES projections as adjusted for the project.

[2] Projections are not available for the associate degree level.

Table 10--Detailed employment demand data for Manufacturing and Processing Scientists and Engineers with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Biological scientists	044	10,404	14,034	20.0	20.0	3,630	403	260	663
Checkers, examiners, and inspectors (manufacturing)	610	7,350	10,000	1.1	1.1	2,650	294	239	533
Chemical engineers	010	484	741	.9	1.2	257	29	9	38
Civil engineers	011	3,692	4,415	2.3	2.3	723	80	106	186
Drafters	152	2,087	2,434	.6	.6	347	39	33	72
Electrical and electronic engineers	012	18,925	23,050	6.2	6.2	4,125	458	315	773
Engineers, nec (agricultural engineers)[2]	023	12,000	15,000	7.4	7.1	3,000	333	300	633
Expeditors and product controllers	323	10,288	13,429	5.0	5.0	3,141	349	264	613
Graders and sorters (manufacturing)	624	4,875	5,338	11.0	11.0	463	51	179	230
Industrial engineers	013	9,250	12,150	5.0	5.0	2,900	322	196	518
Inspectors, scalers, and graders (log and lumber)	450	18,394	19,600	100.0	100.0	1,206	134	629	763
Mechanical engineers	014	12,218	14,580	6.0	6.0	2,362	263	259	522

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1. Developed from OES national Census-based matrix data.
2. Source: Occupational Projections and Training Needs. Bulletin 2020, Bureau of Labor Statistics, Department of Labor, 1979.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Manufacturing and Processing Scientists and Engineers

1970 Census-of-population code	Census occupation	Examples of specific jobs
044	Biological scientist	Animal anatomist Animal physiologist Botanist Dairy bacteriologist Entomologist Geneticist Helminthologist Ichthyologist Pharmaceutical botanist Plant anatomist Range ecologist Toxicologist
610	Checker, examiner, and inspector (manufacturing)	Egg inspector Egg tester Fruit checker Fruit inspector Meat inspector Vegetable inspector
011	Civil engineer	Civil engineer Drainage engineer Forestry engineer Soils engineer Water supply engineer
012	Electrical and electronic engineer	Rural electrification engineer
023	Engineer, nec[1]	Agricultural engineer Consulting engineer (not specified) Environmental engineer
624	Grader and sorter (manufacturing)	Cheese grader Egg grader Fruit grader Potato grader Vegetable grader
073	Industrial engineer	Production control expert Quality control director

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[1] nec = not elsewhere classified.

1970 Census-of-population code	Census occupation	Examples of specific jobs
450	Inspector, scaler, and grader (log and lumber)	Log inspector Log scaler Lumber grader Lumber inspector Veneer grader

Interpretation of Employment Opportunities for Manufacturing and Processing Scientists and Engineers

As shown in Tables 6 and 7, the total average annual supply of graduates qualified for employment as manufacturing and processing scientists and engineers meets approximately 82 percent of the demand. Graduates with agriculture degrees equal 74 percent of the demand; agriculture-related graduates satisfy an additional 8 percent of employment demand. When graduates at the different degree levels are related to total demand, the data indicate that doctoral and D.V.M. graduates satisfy 6 percent of employment demand; master's satisfy 14 percent; baccalaureate's equal 61 percent of average annual demand.

Emphases on energy efficiency, quality control, and improved alternative food sources as they relate to agricultural production, processing, and natural resources are expected to escalate. Consequently, the 1980's should afford substantial employment opportunities for manufacturing and processing agriculturists, food scientists, and forest engineers. Employment demand should be particularly strong for graduates with advanced degrees.

Specific educational backgrounds which appear to be especially needed include:

- Agricultural Engineering
- Food Sciences (food development, processing, and quality control)
- Forest Engineering
- Veterinary Medicine (biological research and regulatory medicine)
- Forest Products Utilization (lumber, plywood, and wood-composition or particle board as related to the pulp and paper industries)--primarily master's and doctoral degree levels

Sales and Service Representatives and Purchasing Agents (Occupational Cluster #3)

Included in this cluster are the occupations related to retailing of agricultural and food products, as well as occupations involved in the sales of inputs (e.g., feed, seed, fertilizer, pesticides, machinery) to producers and processors. Service occupations directly associated with buying, producing, and selling are also included (e.g., representatives who provide lawn and ornamental horticultural services).

Table 11--Supply of Agriculture graduates qualified for employment as Sales and Service Representatives and Purchasing Agents[1]

	Associate[2]	Baccalaureate	Master's	Doctor of Veterinary Medicine	Total[3]
Survey of Agriculture graduates:					
Current, 1976-77	935	6,875	623	125	8,559
Projected, 1985-86	NA	8,506	746	160	9,412
Average annual, 1976-86	NA	7,691	684	143	8,518
Supply of Agriculture-related graduates:					
Current, 1976-77	443	3,113	219	--	3,775
Projected, 1985-86	NA	3,487	257	--	3,744
Average annual, 1976-86	NA	3,300	238	--	3,538

1. Estimates represent summations of data in Tables 13 and 14.
2. Projections are not available (NA) for the associate degree level.
3. Associate degree recipients are included only in the "Current" total.

Table 12--Employment demand for Sales and Service Representatives and Purchasing Agents with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Buyers and shippers (farm products)	15,999	74.8	812
Buyers (wholesale and retail trade)	13,536	8.2	1,702
Demonstrators	327	.6	17
Gardeners and groundskeepers (except farm)	14,976	2.4	1,067
Insurance agents, brokers, underwriters	9,547	2.0	515
Managers and administrators, nec[4]	168,753	3.0	5,960
Purchasing agents and buyers	7,651	4.0	304
Real estate agents and brokers	9,018	2.0	872
Restaurant, cafe, and bar managers	5,516	1.0	286
Sales managers and department heads (retail trade)	21,878	6.7	1,300
Sales managers (except retail trade)	27,269	9.2	671
Sales workers and sales clerks, nec[4]	49,756	1.2	1,813
Total	344,226		15,319

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1. Based on OES Census-based data; detailed data are shown in Table 15.
2. Number of workers estimated as possessing higher education in food/agriculture.
3. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.
4. nec = not elsewhere classified.

Table 13--1976-77 supply of graduates qualified for employment as Sales and Service Representatives and Purchasing Agents[1]

Educational cluster	Associate	Baccalaureate	Master's	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
General Agriculture	--	37	4	--	41
Agricultural Business and Management	23	1,082	67	--	1,172
Agricultural Engineering	118	102	--	--	220
Agricultural Social Sciences	0	170	85	--	255
Animal Sciences	234	1,747	121	125	2,227
Food Sciences	44	820	69	--	933
Natural Resources	74	987	69	--	1,130
Plant Sciences	442	1,637	176	--	2,255
Soil Sciences	--	294	32	--	326
Total	935	6,876	623	125	8,559
Supply of Agriculture-related graduates:					
Agricultural Business and Management	410	2,173	109	--	2,692
Agricultural Engineering	10	38	--	--	48
Agricultural Related Sciences	--	231	5	--	236
Agricultural Social Sciences	--	103	36	--	139
Animal Sciences	19	453	52	--	524
Food Sciences	1	16	1	--	18
International Agriculture	--	10	--	--	10
Natural Resources	3	29	3	--	35
Plant Sciences	--	57	12	--	69
Soil Sciences	--	3	1	--	4
Total	443	3,113	219	--	3,775

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1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 14--1985-86 projected supply of graduates qualified for employment as Sales and Service Representatives and Purchasing Agents[1,2]

Educational cluster	Baccalaureate	Master's	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:				
General Agriculture	43	6	--	49
Agricultural Business and Management	1,296	86	--	1,382
Agricultural Engineering	160	--	--	160
Agricultural Social Sciences	170	57	--	227
Animal Sciences	2,188	171	160	2,519
Food Sciences	762	79	--	841
Natural Resources	1,230	84	--	1,314
Plant Sciences	2,268	222	--	2,490
Soil Sciences	389	41	--	430
Total	8,506	746	160	9,412
Supply of Agriculture-related graduates:				
Agricultural Business and Management	2,496	131	--	2,627
Agricultural Engineering	88	--	--	88
Agricultural Related Sciences	237	6	--	243
Agricultural Social Sciences	115	36	--	151
Animal Sciences	413	66	--	479
Food Sciences	16	1	--	17
International Agriculture	15	--	--	15
Natural Resources	32	4	--	36
Plant Sciences	72	12	--	84
Soil Sciences	3	1	--	4
Total	3,487	257	--	3,744

1. Based upon NCES projections as adjusted for the project.
2. Projections are not available for the associate degree level.

Table 15--Detailed employment demand data for Sales and Service Representatives and Purchasing Agents with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Buyers and shippers (farm products)	203	15,999	16,433	74.8	74.7	434	48	764	812
Buyers (wholesale and retail trade)	205	13,536	22,625	8.2	9.8	9,089	1,010	692	1,702
Demonstrators	262	327	379	.6	.6	52	6	11	17
Gardeners and groundskeepers	755	14,976	16,778	2.4	2.6	1,802	200	867	1,067
Insurance agents, brokers, and underwriters	265	9,547	11,311	2.0	2.0	2,481	276	596	872
Managers and administrators, nec[2]	245	168,753	175,253	74.8	74.7	434	48	764	812
Purchasing agents and buyers, nec[2]	225	7,651	8,394	4.0	3.2	743	83	221	304
Real estate agents and brokers	270	9,018	11,499	2.0	2.0	2,481	276	596	872
Restaurant, cafe, and bar managers	230	5,516	6,198	1.0	1.0	682	76	210	286
Sales managers and department heads (retail trade)	231	21,878	28,153	6.7	6.5	6,275	697	603	1,300
Sales managers (except retail trade)	233	27,269	28,034	9.2	7.1	765	85	586	671
Sales workers and sales clerks, nec[2]	281-285	49,756	49,386	1.2	1.0	<370>	<41	1,854	1,813

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1. Developed from OES national Census-based matrix data.
2. nec = not elsewhere classified.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Sales and Service Representatives and Purchasing Agents

1970 Census-of-population code	Census occupation	Examples of specific jobs
203	Buyer and shipper (farm products)	Farm products shipper Field representative Livestock buyer Livestock commission agent Livestock tracer Produce shipper Seed buyer Tobacco buyer
205	Buyer (wholesale and retail trade)	Grain-elevator buyer Merchandise executive
262	Demonstrator	Meat products demonstrator Sales demonstrator
744	Gardener and grounds-keeper (except farm)	Diagnostician (tree surgery) Gardener Landscape gardener Park keeper Tree doctor Tree expert
245	Manager and administrator, nec[1]	Cattle broker Elevator operator (grain) Farm labor contractor Farm loan representative Farm-mortgage agent Food broker Grain broker Grain trader Hatchery manager Landscape contractor Livestock broker Manager (not specified) Marketing manager Production control manager
225	Purchasing agent and buyer, nec[1]	Food buyer Pulpwood buyer Purchasing agent Timber buyer
231	Sales manager and department head (retail trade)	Dairy department manager Produce department manager Sales manager

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1. nec = not elsewhere classified.

1970 Census-of-population code	Census occupation	Examples of specific jobs
280	Sales workers and sales clerks, nec[1]	Food counselor Garden consultant Merchandise shopper Tree agent

Interpretation of Employment Opportunities for Sales and Service Representatives and Purchasing Agents

Essentially all phases of the food delivery system require the procurement of raw materials and the marketing of products. Therefore, an extensive number of representatives and agents are needed in the marketing process. The supply/demand data for sales and service representatives and purchasing agents suggest an annual shortage of almost 2,000 graduates, or 12 percent of unmet demand.

Sales occupations, buying positions, and technical services directly affecting farming and ranching are strongly correlated to the level of agricultural production. With anticipated increases in agricultural output in the 1980's, there should be an associated modest increase in the number of retailing positions. Graduates with a technical subject matter understanding as well as business and marketing training should be in the strongest position to compete for employment. Graduates from the plant sciences, animal sciences, agricultural mechanization and agricultural business curricula should continue to attract substantial interest from employers seeking sales representatives to serve farmers and ranchers.

It is anticipated that Americans will continue the trend of the 1970's and consume an increasing proportion of meals outside the home. Consequently, there should be a continuing high demand for food sales representatives, food buyers, and retail food service managers. Primary candidates for these positions will be individuals with associate and baccalaureate degrees in food technology and food science.

Two factors might tend to restrict the market for sales representatives, buyers, and technical service representatives during the coming decade. Restricted foreign markets could result in decreased agricultural production. A general economic recession could result in reduced demand for agricultural products, especially those intended to enhance the quality of life (e.g., ornamental house plants).

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[1] nec = not elsewhere classified.

Administrators, Managers, and Financial Advisors
(Occupational Cluster #4)

Included in this cluster are the food and agricultural occupations which require managerial and administrative competencies. The occupations involve financial management, public administration, real estate appraisal, business analysis, and program direction.

Table 16--Supply of Agriculture graduates qualified for employment as Administrators, Managers, and Financial Advisors[1]

	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Current, 1976-77	1,368	533	44	1,945
Projected, 1985-86	1,696	595	56	2,347
Average annual, 1976-86	1,532	564	50	2,146
Supply of Agriculture-related graduates:				
Current, 1976-77	1,546	439	10	1,995
Projected, 1985-86	1,759	520	19	2,298
Average annual, 1976-86	1,653	480	14	2,147

1. Estimates represent summations of data in Tables 18 and 19.

Table 17--Employment demand for Administrators, Managers, and Financial Advisors with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Accountants	14,100	1.6	525
Assessors, controllers, and treasurers (local public administration)	718	2.0	46
Bank officers and financial managers	9,532	1.9	746
Blue-collar worker supervisors	12,950	.9	427
Credit and collection managers	954	1.8	32
Economists	4,690	4.4	246
Estimators and investigators, nec[4]	14,840	3.6	1,111
Insurance adjusters, examiners, and investigators	17,673	11.6	893
Officials and administrators, nec (public administration)	14,743	5.0	988
Personnel and labor relations workers	3,206	.9	123
Real estate appraisers	1,520	5.0	102
Stock and bond sales agents	17,213	18.9	945
Total	112,139		6,184

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1. Based on OES Census-based data; detailed data are shown in Table 20.
2. Number of workers estimated as possessing higher education in food/agriculture.
3. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.
4. nec = not elsewhere classified.

Table 18--1976-77 supply of graduates qualified for employment as Administrators, Managers, and Financial Advisors[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Agricultural Business and Management	721	235	44	1,000
Agricultural Social Sciences	34	127	--	161
Animal Sciences	250	--	--	250
Natural Resources	99	139	--	238
Plant Sciences	205	--	--	205
Soil Sciences	59	32	--	91
Total	1,368	533	44	1,945
Supply of Agriculture-related graduates:				
Agricultural Business and Management	1,449	380	10	1,839
Agricultural Social Sciences	21	53	--	74
Animal Sciences	65	--	--	65
Natural Resources	3	6	--	9
Plant Sciences	7	--	--	7
Soil Sciences	1	--	--	1
Total	1,546	439	10	1,995

1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 19--1985-86 projected supply of graduates qualified for employment as Administrators, Managers, and Financial Advisors[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Agricultural Business and Management	864	300	56	1,220
Agricultural Social Sciences	34	86	--	120
Animal Sciences	313	--	--	313
Natural Resources	123	168	--	291
Plant Sciences	284	--	--	284
Soil Sciences	78	41	--	119
Total	1,696	595	56	2,347
Supply of Agriculture-related graduates:				
Agricultural Business and Management	1,664	460	19	2,143
Agricultural Social Sciences	23	53	--	76
Animal Sciences	59	--	--	59
Natural Resources	3	7	--	10
Plant Sciences	9	--	--	9
Soil Sciences	1	--	--	1
Total	1,759	520	19	2,298

1. Based upon NCES projections as adjusted for the project.

Table 20--Detailed employment demand data for Administrators, Managers, and Financial Advisors with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Accountants	001	14,100	14,772	1.6	1.4	672	75	450	525
Assessors, controllers, and treasurers (local public administration)	201	718	800	2.0	2.0	82	9	37	46
Bank officers and financial managers	202	9,532	13,247	1.9	1.9	3,715	413	333	746
Blue-collar worker supervisors, nec[2]	441	12,950	13,770	.9	.8	820	91	336	427
Credit and collection managers	210	954	988	1.8	1.6	34	4	28	32
Economists	091	4,690	5,907	4.4	4.4	1,217	135	111	246
Estimators and investigators, nec	321	14,840	19,941	3.6	4.0	5,101	567	544	1,111
Insurance adjusters, examiners, and investigators	326	17,673	21,827	11.3	11.5	4,154	462	431	893
Officials and administrators, nec (public administration)	222	14,743	17,739	5.0	5.0	2,996	333	655	988
Personnel and labor relations workers	056	3,206	3,566	.9	.8	360	40	83	123
Real estate appraisers	363	1,520	1,722	5.0	4.4	202	22	80	102
Stock and bond sales agents	271	17,213	19,564	18.9	18.6	2,351	261	684	945

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1. Developed from OES national Census-based matrix data.
2. nec = not elsewhere classified.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Administrators, Managers, and Financial Advisors

1970 Census-of-population code	Census occupation	Examples of specific jobs
201	Assessor, controller, treasurer (local public administration)	Land appraiser
091	Economist	Agricultural economist Forest economist Market analyst Marketing forecaster Trade economist
321	Estimator and investigator, nec[1]	Compensation expert Farm loan inspector Freight-claim investigator Land inspector
222	Official and administrator, nec[1] (public administration)	Contract analyst Division chief Fish and game warden Park superintendent State game protector Tree warden

Interpretation of Employment Opportunities for Administrators, Managers, and Financial Advisors

A review of the available supply and demand data indicates a strong employment market for graduates trained as administrators, managers, and advisors. Qualified doctoral graduates are available to fill only 1 percent of the estimated demand. Master's and baccalaureate graduates equal 17 and 52 percent, respectively, of the estimated average annual demand. In essence, the total average annual supply of new graduates satisfies only 70 percent of the estimated employment demand.

Increased emphasis on alternative land use and the related need for economic impact analyses require trained estimators and appraisers. Maintenance of a high quality environment further expands the demand for investigators and appraisers with expertise in soils, plants, and natural resource utilization.

Financial managers should continue to be in strong demand during the 1980's because of trends toward larger firms, restricted money supplies, smaller operating margins, more extensive use of credit, increased use of tax management strategies, and more complex organizational structures in conducting farming and agribusiness operations. Individuals with a master's degree in agricultural economics emphasizing financial analysis and management skills are particularly in short supply as compared to demand.

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[1] nec = not elsewhere classified.

Managerial decisions in food, agriculture, and natural resources should increasingly require technical expertise in problem solving as well as in economic and social impacts of strategies adopted. Consequently, individuals with a degree in a technical field combined with a business emphasis should be in a strong position to advance to an advisory or managerial role in food or agricultural industries, as well as public administration.

Educators
(Occupational Cluster #5)

Included in this cluster are secondary school vocational agriculture teachers, adult education teachers specializing in agriculture and food, and college faculty engaged in teaching and research directly related to agriculture and food. Cooperative Extension Service personnel are also included.

Table 21--Supply of Agriculture graduates qualified for employment as Educators[1]

	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
Current, 1976-77	2,108	983	400	152	3,643
Projected, 1985-86	2,432	1,061	465	200	4,158
Average annual, 1976-86	2,270	1,022	432	176	3,900
Supply of Agriculture-related graduates:					
Current, 1976-77	907	313	137	--	1,357
Projected, 1985-86	1,014	359	143	--	1,516
Average annual, 1976-86	961	336	140	--	1,437

1. Estimates represent summations of data in Tables 23 and 24.

Table 22--Employment demand for Educators with higher education in the food and agricultural sciences

Census occupation	1976 level of occupational employment[1]	Percentage of total 1976 occupational employment[2]	1976-85 estimated average annual openings
Adult educators[3]	1,680	3.0	118
Cooperative Extension Services workers[4,5]	12,159	65.0	1,255
College and university teaching and research faculty[6]			
Agriculture	13,235[7]	100.0	450
Natural Resources	755[7]	100.0	20
Forestry	2,690[7]	100.0	115
Veterinary Medicine	3,356[7]	100.0	138
Secondary vocational agriculture teachers[8]	13,000		1,600
Total	46,875		3,696

1. Number of workers estimated as possessing higher education in food/agriculture.

2. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.

3. 1976 employment and 1976-85 annual average openings based on OES Census-based data; detailed data are shown in Table 25.

4. Based upon analysis of January 1980, USDA-SEA data on Cooperative Extension Services as shown in Tables 26 and 27.

5. Includes only extension personnel employed as agricultural specialists; does not include home economics extension personnel.

6. Based upon data from 1979-80 Clemson University study as shown in Tables 28 and 29.

7. Figure represents responses to Clemson University survey as extrapolated for the population of colleges/universities. Extrapolation methodology consisted of dividing the sum of survey responses by the response rate.

8. Estimation based upon data collected and reported by the Professional Personnel Recruitment Committee, Agricultural Education Division, American Vocational Association as shown in Table 30.

Table 23--1976-77 supply of graduates qualified for employment as Educators[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
General Agriculture	9	--	--	--	9
Agricultural Business and Management	180	67	29	--	276
Agricultural Engineering	25	13	1	--	39
Agricultural Social Sciences	678	297	16	--	991
Animal Sciences	399	122	68	152	741
Food Sciences	273	207	71	--	551
Natural Resources	99	69	38	--	206
Plant Sciences	327	176	136	--	639
Soil Sciences	118	32	41	--	191
Total	2,108	983	400	152	3,643
Supply of Agriculture-related graduates:					
Agricultural Business and Management	362	109	7	--	478
Agricultural Engineering	9	10	--	--	19
Agricultural Related Sciences	--	--	22	--	22
Agricultural Social Sciences	413	125	7	--	545
Animal Sciences	103	51	82	--	236
Food Sciences	5	3	--	--	8
Natural Resources	3	3	3	--	9
Plant Sciences	11	12	16	--	39
Soil Sciences	1	--	--	--	1
Total	907	313	137	--	1,357

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1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 24--1985-86 projected supply of graduates qualified for employment as Educators[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Doctor of Veterinary Medicine	Total
Supply of Agriculture graduates:					
General Agriculture	10	--	--	--	10
Agricultural Business and Management	216	86	37	--	339
Agricultural Engineering	40	19	3	--	62
Agricultural Social Sciences	680	200	11	--	891
Animal Sciences	500	171	79	200	950
Food Sciences	254	238	77	--	569
Natural Resources	123	84	49	--	256
Plant Sciences	453	222	156	--	831
Soil Sciences	156	41	53	--	250
Total	2,432	1,061	465	200	4,158
Supply of Agriculture-related graduates:					
Agricultural Business and Management	416	131	13	--	560
Agricultural Engineering	22	17	--	--	39
Agricultural Related Sciences	--	--	21	--	21
Agricultural Social Sciences	459	125	10	--	594
Animal Sciences	94	66	80	--	240
Food Sciences	5	3	--	--	8
Natural Resources	3	4	4	--	11
Plant Sciences	14	12	15	--	41
Soil Sciences	1	1	--	--	2
Total	1,014	359	143	--	1,516

1. Based upon NCES projections as adjusted for the project.

Table 25--Detailed employment demand data for Educators with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Adult educators	141	1,680	2,250	3.0	3.0	570	63	55	118

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1. Developed from OES national Census-based matrix data.

Table 26--1979 employment and projected demand for Educators with higher education in the food and agricultural sciences in the Cooperative Extension Services by position, 1979-85[1]

Position	Total employment 1979[2]	Agriculture personnel				Home economics personnel			
		Employment 1979[2]	Estimated average annual growth 1979-85[3]	Average annual replacements 1970-79[2,4]	Estimated average annual openings 1979-85[4]	Employment 1979[2]	Estimated average annual growth 1979-85[3]	Average annual replacements 1970-79[2,4]	Estimated average annual openings 1979-85[4]
Area Agent	694	606	60			88	13		
County Agent	11,616	6,590	200			5,026	104		
State Specialist	4,580	3,644	136			936	13		
Supervisor	749	532	--			217	--		
Other	1,023	787	--			236	--		
Total	18,662	12,159	396	859	1,255	6,503	130	735	865

1. Methodology underlying analysis of the data is presented in Appendix 22.
2. Based on 1970-79 Cooperative Extension Services data.
3. Estimates provided by USDA, SEA-Extension.
4. Position subtotals are unavailable.

Table 27--1979 employment and projected demand for Educators with higher education in the food and agricultural sciences in the Cooperative Extension Services by area of responsibility, 1979-85[1]

Employment category	Area of responsibility						
	Agriculture and natural resources	Community and resource development	Home economics and family living	4-H and youth	Administration	Undesignated	Total
1979 Employment[2]							
Agriculture	7,428	825	203	1,940	1,367	366	12,159
Home Economics	372	167	4,002	1,345	353	264	6,503
Total	7,800	992	4,205	3,285	1,720	660	18,662
Estimated annual average growth, 1979-85[3]							
Agriculture	198	59	40	99	--	--	396
Home Economics	--	16	91	23	--	--	130
Total	198	75	131	122	--	--	526
Annual average replacements, 1970-79[2,4]							
Agriculture							859
Home Economics							735
Total							1,594

1. Methodology underlying analysis of the data is presented in Appendix 22.
2. Based on 1970-79 Cooperative Extension Services data.
3. Estimates provided by USDA, SEA-Extension.
4. Area of Responsibility subtotals are unavailable.

Table 28--Summary of number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]

Teaching/ research field	Sample responses				1980-89 estimated average annual openings (population)[4]
	Fall 1979		1980-89 estimated total retirements[2]	1980-89 estimated average annual retirements[3]	
	Total employment[2]	Total unfilled positions[2]			
Agriculture	7,822	266	1,334	133	450
Natural Resources	446	18	32	3	20
Forestry	1,267	86	108	11	115
Veterinary Medicine	1,678	108	165	15	138

1. Detailed data are presented in Table 29.
2. Data represent summations of figures provided by survey respondents--59 percent of all Colleges of Agriculture/Natural Resources, 47 percent of all Schools of Forestry, and 50 percent of all Colleges of Veterinary Medicine.
3. Estimated total retirements, 1980-89, divided by number of years in period (10).
4. Extrapolated to represent the population of colleges/universities with programs in Agriculture/Natural Resources, Forestry, and Veterinary Medicine: It was assumed that one-half of the reported 1979 unfilled positions represent openings due to an unadjusted chronic shortage of faculty and the remaining one-half represent openings due to turnover, migration, and mobility. Therefore, estimated annual average openings were computed by summing annual average retirements and that half of unfilled positions due to turnover, migration, and mobility. This sum was then extrapolated to represent the total population by dividing by the response rate (.591 for Agriculture and Natural Resources, .471 for Forestry, and .50 for Veterinary Medicine).

Table 29--Number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]

Teaching/research field	Sample responses[2]					1980-89 estimated average annual openings (population)[5]
	Fall 1979 employment		Fall 1979 unfilled positions	1980-89 estimated total retirements[3]	1980-89 estimated average annual retirements[4]	
	Total	Minorities[2]				
AGRICULTURE						
General Agriculture	40	7	1	20	2	4
Agriculture Economics						
General	646	16	24	95	10	37
Agricultural Business/Management	300	11	10	34	3	14
Farm Management	52	--	--	32	3	5
Agricultural Communications	95	--	7	17	2	9
Agricultural Education/Extension	219	5	13	38	4	18
Agricultural Engineering						
Agricultural Engineering Science	493	15	20	60	6	27
Agricultural Mechanization	124	4	4	17	2	6
Animal Sciences						
General	510	44	28	98	10	40
Livestock	246	1	8	43	4	14
Dairy Production	214	4	7	36	4	13
Poultry Science	162	5	4	31	3	8
Animal Breeding	59	4	--	9	1	1
Animal Health	29	--	--	--	--	--
Animal Nutrition	121	1	3	23	2	6
Animal Physiology	62	--	--	9	1	1
Entomology	310	13	8	16	2	10

Footnotes at end of table

Table 29--Number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]--Continued

Teaching/research field	Sample responses[2]					1980-89 estimated average annual openings (population)[5]
	Fall 1979 employment		Fall 1979 unfilled positions	1980-89 estimated total retirements[3]	1980-89 estimated average annual retirements[4]	
	Total	Minorities[2]				
Food Sciences[6]	304	18	10	52	5	17
General	304	18	10	52	5	17
Dairy Processing	24	--	--	7	1	1
Food Technology	172	11	6	74	7	17
Food Engineering	19	5	1	2	--	1
Human Nutrition[6]	101	11	4	18	2	7
International Agriculture	25	2	--	5	1	1
Plant Sciences						
General	342	2	10	51	5	17
Agronomy	816	28	30	116	12	46
Horticulture						
Fruit and Vegetables	448	9	24	98	10	37
Landscape	69	2	2	7	1	3
Ornamental	199	6	3	27	3	8
Plant Breeding	129	1	1	29	3	6
Integrated Pest Management	269	11	5	36	4	11
Plant Pathology	446	47	17	88	9	30
Plant Physiology	149	6	2	24	2	5
Range Science	82	4	1	13	1	3
Turf Management	24	7	1	6	1	3
Rural Sociology	64	5	--	10	1	1
Soil Sciences						
General	214	3	8	48	5	15
Conservation	42	1	1	9	1	3
Fertility/Management	75	9	1	21	2	4
Chemistry	55	4	1	9	1	3
Microbiology	42	6	1	3	--	1
Physics	30	--	--	3	--	--
Total[7]	7,822	328	266	1,334	133	450

Table 29--Number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]--Continued

Teaching/research field	Sample responses[2]					1980-89 estimated average annual openings (population)[5]
	Fall 1979 employment		Fall 1979 unfilled positions	1980-89 estimated total retirements[3]	1980-89 estimated average annual retirements[4]	
	Total	Minorities[2]				
NATURAL RESOURCES						
General	49	--	2	5	1	3
Aquaculture	3	--	3	--	--	3
Atmospheric Science	14	1	--	--	--	--
Fisheries	116	4	1	4	--	1
Marine Biology	12	--	2	4	--	2
Recreation (excluding Activities Administration)	97	2	4	5	1	5
Water Resources	13	1	3	4	--	3
Wildlife (Biology/ Management)	142	1	3	10	1	4
Total[7]	446	9	18	32	3	20
FORESTRY						
General	112	5	29	17	2	35
Forest Engineering	67	--	13	4	--	14
Forest Management	218	7	16	26	3	23
Wood Science, Technology and Industry	155	16	11	18	2	16
Silviculture	180	2	12	12	1	15
Timber Management	75	2	--	3	--	--
Urban Forestry	4	--	2	--	--	2

Table 29--Number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]--Continued

	Sample responses[2]					1980-89 estimated average annual openings (population)[5]
	Fall 1979 employment		Fall 1979 unfilled positions	1980-89 estimated total retirements[3]	1980-89 estimated average annual retirements[4]	
Teaching/research field	Total	Minorities[2]				
FORESTRY (Continued)						
Other[8]	456	6	3	28	3	10
Total[7]	1,267	38	86	108	11	115
VETERINARY MEDICINE						
Pre-Clinical or Basic Sciences[9]						
General	111	3	4	18	2	8
Anatomy	225	17	8	17	2	12
Microbiology	258	9	17	34	3	23
Pathology	74	5	21	14	1	23
Pharmacology	147	1	2	6	1	4
Physiology	145	16	2	11	1	4
Toxicology	33	2	6	3	--	6
Clinical Sciences						
Anesthesiology	104	--	5	4	--	5
Clinical Nutrition	14	--	2	1	--	2
Internal Medicine	156	--	9	11	1	11
Laboratory Animal Medicine	28	--	4	4	--	4
Opthalmology	18	--	1	4	--	1
Preventive Medicine	38	1	6	6	1	9
Radiology	36	--	1	--	--	1
Reproductive Biology	37	3	1	3	--	1
Surgery	100	5	5	8	1	7
Other[10]	154	3	14	21	2	18
Total[7]	1,678	65	108	165	15	138

[1] Based on 1979-80 Clemson University Survey of Students and Faculty in Higher Education in Agriculture/Natural Resources, Forestry, Veterinary Medicine, and Home Economics funded by the U.S. Department of Agriculture. Project directors were Dr. Edward L. McLean and Dr. Stephen R. Chapman.

(Footnotes continued)

Table 29--Number of faculty members in higher education teaching and research in Agriculture/Natural Resources, Forestry, and Veterinary Medicine, 1979, and estimated retirements and average annual openings, 1980-89[1]--Continued

Footnotes (Continued)

2. Includes racial and ethnic minorities employed by responding institutions; does not include Anglo females.

3. Total retirements estimated by responding institutions, 1980-89.

4. Total retirements, 1980-89, estimated by responding institutions and divided by number of years in the period (10).

5. Extrapolated to represent population of colleges/universities with programs in agriculture, natural resources, forestry, and veterinary medicine: It was assumed that one-half of the reported 1979 unfilled positions represent openings due to an unadjusted chronic shortage of faculty and the remaining one-half represent openings due to turnover, migration, and mobility. Therefore, estimated average annual openings were computed by summing average annual retirements and that half of unfilled positions due to turnover, migration, and mobility. This sum was then extrapolated to represent the total population by dividing by the response rate (.591 for Agriculture and Natural Resources, .471 for Forestry, and .50 for Veterinary Medicine) or, equivalently, multiplying by the reciprocal of the response rate.

6. Includes only faculty in agriculture; faculty in home economics are reported in Volume II.

7. Because of rounding, details may not add to total.

8. Most frequently listed specialty titles under "other" included Forest Recreation, Forest Wildlife, Fish and Wildlife, Forest/Wood Science, Wildlife Management, Range Management/Science, and Remote Sensing.

9. Includes faculty in Colleges of Agriculture as well as Colleges of Veterinary Medicine.

10. Most frequently listed specialty titles under "other" included Epidemiology and Public Health, Parasitology, Clinical Medicine, Clinical Pathology, and Virology.

Table 30--Supply of and demand for Secondary Vocational Agriculture Teachers, 1967-1979[1]

Year	Total teaching positions	Demand (annual openings)	Graduates certified in agriculture education		Agriculture education graduates entering teaching			Unfilled demand (unfilled positions)
			Number	Percent of demand	Number	Percent of agriculture education graduates	Percent of demand	
1967-68	10,221	1,330	1,256	94.4	753	59.9	56.6	577
1968-69	10,606	1,396	1,313	94.0	809	61.6	57.9	587
1969-70	10,560	1,282	1,562	121.8	891	57.0	69.5	391
1970-71	10,520	1,197	1,699	139.4	866	51.0	72.3	331
1971-72	10,438	1,104	1,738	157.4	860	49.5	77.9	244
1972-73	10,714	1,339	1,768	132.0	967	54.7	72.2	372
1973-74	11,141	1,556	1,713	110.0	966	56.4	62.1	590
1974-75	11,578	1,748	1,623	92.8	943	58.1	53.9	805
1975-76	12,107	1,667	1,660	99.6	999	60.2	59.9	668
1976-77	12,484	1,653	1,697	102.7	1,043	61.5	63.1	610
1977-78	12,694	1,615	1,738	107.6	1,061	61.0	65.7	554
1978-79	12,844	1,576	1,751	111.1	974	55.6	61.8	602
12-year average	—	1,455	1,626	111.8	928	57.0	63.7	528

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1. Based on annual surveys conducted by the Professional Personnel Recruitment Committee, Agricultural Education Division, American Vocational Association.

Interpretation of Employment Opportunities for Educators

Several observations are pertinent when reviewing the supply/demand data for food and agricultural educators in the 1980's. Various sources suggest regional differences in higher education enrollment patterns with projected increases in some areas and projected declining enrollments in other areas. Despite NCES enrollment projections which are based largely on the growth of agricultural colleges in the early 1970's, many leading educators predict stable or declining student enrollments in the food, agricultural, and natural resources programs during the 1980's. Hopefully, the adjustments of the 1980's will not result in fewer courses taught and fewer professors needed, but rather will result in a return to more optimum class size and teaching load.

In response to an expanded need for teaching and research, many agricultural colleges increased their faculties during the post-World War II period of the late 1940's and early 1950's. It is expected that a greater-than-average number of Ph.D. graduates will be needed as replacements during the late 1980's because an above-average number of current faculty members will reach retirement age. Recent changes in the normal retirement age from 65 to 70 may have some impact.

Based on the data presented in this report, present chronic shortages of college/university faculty in several areas warrant attention. These areas include: agronomy, animal sciences (general), agricultural economics, horticulture (fruit and vegetable), agricultural engineering, wildlife biology/management, water resources, aquaculture, forest management, forest engineering, wood science technology and industry, and veterinary medicine (pathology, internal medicine, microbiology, and anatomy).

During the next 10-year period, the most critical needs for additional agricultural educators at the college level appear to be for doctoral graduates in agricultural engineering, agricultural business/management (particularly agricultural economics), animal sciences (particularly dairy and livestock production), aquaculture, fisheries, wildlife biology and management, forest engineering, forest management, wood science technology and industry, and plant sciences (agronomy, fruit and vegetable horticulture, and plant pathology). In veterinary medicine, additional educators are needed with specializations in anatomy, internal medicine, microbiology, pathology, preventive medicine, and surgery.

An expanding need for dissemination of new knowledge and technology related to agricultural production, natural resource utilization, and rural development substantiates a significant demand for Cooperative Extension Service personnel based in local areas and on university campuses.

A recent report conducted by the agricultural education staff of The Ohio State University and published by the American Vocational Association, indicates an annual deficiency of 600-750 secondary school vocational agriculture teachers.

In the aggregate, it appears that the supply of educators exceeds the demand. Yet, it is important to note the aforementioned shortages which are apparently the result of (1) competition for trained educators by business and industry, and (2) inadequate supplies of graduates of certain fields. Simply stated, in many instances educational institutions are apparently being outbid by business and industry for trained educators. In other instances, the supply is far short of the demand.

Media Specialists
(Occupational Cluster #6)

Included in this cluster are the professional workers in all media; e.g., radio, television, newspapers, and other publishing firms which specialize in reporting for food and agriculture. In general, these specialists are journalists, librarians, public relations specialists, and archivists. The occupation of curator is included as many of its functions are analogous to that of the archivist.

Table 31--Supply of Agriculture graduates qualified for employment as Media Specialists[1]

Item	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Current, 1976-77	255	212	5	472
Projected, 1985-86	255	143	3	401
Average annual, 1976-86	255	178	4	437
Supply of Agriculture-related graduates:				
Current, 1976-77	155	89	2	246
Projected, 1985-86	172	89	3	264
Average annual, 1976-86	164	89	2	255

1. Estimates represent summations of data in Tables 33 and 34.

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Table 32--Employment demand for Media Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Advertising agents and salesworkers	306	.3	14
Archivists and curators	301	3.2	14
Authors	84	.2	12
Editors and reporters	3,174	1.9	226
Librarians	70	.05	7
Photographers	91	.1	7
Public relations specialists and publicity writers	2,242	1.9	134
Radio and television announcers	758	2.9	33
Writers, artists, and entertainers	2,925	2.9	58
Total	9,951		505

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1. Based on OES Census-based data; detailed data are shown in Table 35.
2. Number of workers estimated as possessing higher education in food/agriculture.
3. Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.

Table 33--1976-77 supply of graduates qualified for employment as Media Specialists[1]

Educational cluster	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Agricultural Social Sciences	255	212	5	472
Total	255	212	5	472
Supply of Agriculture-related graduates:				
Agricultural Social Sciences	155	89	2	246
Total	155	89	2	246

1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 34--1985-86 projected supply of graduates qualified for employment as Media Specialists[1].

Educational cluster	Baccalaureate	Master's	Doctorate	Total
Supply of Agriculture graduates:				
Agricultural Social Sciences	255	143	3	401
Total	255	143	3	401
Supply of Agriculture-related graduates:				
Agricultural Social Sciences	172	89	3	264
Total	172	89	3	264

1. Based upon NCES projections as adjusted for purposes of the project.

Table 35--Detailed employment demand data for Media Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Advertising agents and salesworkers	260	306	346	.3	.3	40	4	10	14
Archivists and curators	033	301	309	3.2	3.1	8	1	13	14
Authors	181	84	152	.2	.4	68	8	4	12
Editors and reporters	184	3,174	4,115	1.9	2.0	941	105	121	226
Librarians	032	70	95	.05	.06	25	3	4	7
Photographers	191	91	123	.1	.1	32	4	3	7
Public relations specialists and publicity writers	192	2,242	2,733	1.9	1.8	491	55	79	134
Radio and television announcers	193	758	967	2.9	2.8	209	23	10	33
Writers, artists, and entertainers, nec[2]	194	2,925	2,746	2.9	2.5	<179>	<20>	78	58

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1. Developed from OES national Census-based matrix data.
2. nec = not elsewhere classified.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Media Specialists

1970 Census-of-population code	Census occupation	Examples of specific jobs
033	Archivist and curator	Archivist Field collector
181	Author	Professional writer Speechwriter
184	Editor and reporter	Information specialist Journalist Magazine editor Market editor Technical editor
191	Photographer	Aerial photographer Biological photographer
192	Public relations specialist and publicity writer	Director of information Public relations specialist
193	Radio and television announcer	Broadcaster Newscaster
194	Writer, artist, and entertainer, nec[1]	Animal trainer Technical writer

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[1] nec = not elsewhere classified.

Interpretation of Employment Opportunities for Media Specialists

The total annual average supply of new graduates with food/agriculture/natural resource degrees qualified for employment as media specialists approximates 87 percent of the estimated demand. When graduates with agriculture-related degrees are considered, the total supply exceeds annual demand by almost 200 graduates. Hence, there is no apparent shortage of food/agriculture media specialists.

An important occupational field for food and agricultural media specialists is that consisting of editors, reporters, and writers. Government agriculture/natural resource units employ such personnel to report research findings for use by producers and consumers. Agribusiness firms and commodity organizations employ them to edit and publish newsletters, magazines, and other publications for employees, members, and patrons. Additionally, these types of professionals are employed by publishing firms producing technical journals and books as well as popular magazines for both producers and consumers with food, agricultural, and natural resource concerns.

Other positions for food and agricultural media specialists exist with advertising and public relations firms. An increasing number of professionals are being employed by such agencies as account executives for agricultural clients. Also, some complex conglomerates are expanding the number of agricultural media specialists within their operations to develop intra-company informational publications and newsletters.

The demand data reveal a limited need for librarians and archivists with specific expertise in food and agriculture. Similarly, there appears to be little demand for radio and television agricultural announcers as many stations are utilizing syndicated reports by a relatively few farm broadcasters.

In summary, agricultural communicators are employed primarily as editors, writers, reporters, and public relations specialists for government agencies, agribusiness firms, commodity organizations, and publishing houses. Graduates with multidisciplinary backgrounds in food, agriculture, or natural resources, and communications would appear to be best qualified for these types of occupations. Non-agricultural journalists and media specialists should continue to be a significant competitive factor in the market and should buffer the expansion of career opportunities for food and agricultural media specialists.

Agricultural Production and Management Specialists
(Occupational Cluster #7)

Included in this cluster are all individuals directly involved in the production of raw agricultural products such as grains, fibers, and livestock, including dairy and poultry. Also included are the growers of ornamental horticulture crops.

Table 36--Supply of Agriculture graduates qualified for employment as Agricultural Production and Management Specialists[1]

	Associate[2]	Baccalaureate	Master's	Total[3]
Supply of Agriculture graduates:				
Current, 1976-77	1,068	2,641	185	3,894
Projected, 1985-86	NA	3,362	216	3,578
Average annual, 1976-86	NA	3,001	201	3,202
Supply of Agriculture-related graduates:				
Current, 1976-77	316	1,417	143	1,876
Projected, 1985-86	NA	1,575	168	1,743
Average annual, 1976-86	NA	1,496	156	1,652

1. Estimates represent summations of data in Tables 38 and 39.
2. Projections are not available (NA) for the associate degree level.
3. Associate degree recipients are included only in the "Current" total.

Table 37--Employment demand for Agricultural Production and Management Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Farm labor supervisors	3,100	10.0	65
Farm management advisors[4]	1,250	100.0	8
Farm managers	20,000	80.0	2,391
Farm service laborers (self-employed)	1,000	10.0	53
Farmers (owners and tenants)	223,193	15.0	3,728
Total	248,543		6,245

[1] Based on OES Census-based data; detailed data are shown in Table 40.

[2] Number of workers estimated as possessing higher education in food/agriculture.

[3] Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.

[4] Excludes Cooperative Extension Service personnel, who are reported under the Occupational Cluster for Educators.

Table 38--1976-77 supply of graduates qualified for employment as Agricultural Production and Management Specialists[1]

Educational cluster	Associate	Baccalaureate	Master's	Total
Supply of Agriculture graduates:				
General Agriculture	--	37	2	39
Agricultural Business and Management	16	541	67	624
Agricultural Engineering	118	25	--	143
Agricultural Social Sciences	--	51	42	93
Animal Sciences	374	998	30	1,402
Natural Resources	44	198	--	242
Plant Sciences	516	614	44	1,174
Soil Sciences	--	177	--	177
Total	1,068	2,641	185	3,894
Supply of Agriculture-related graduates:				
Agricultural Business and Management	273	1,087	109	1,469
Agricultural Engineering	10	10	--	20
Agricultural Social Sciences	--	31	18	49
Animal Sciences	30	259	13	302
Natural Resources	2	6	--	8
Plant Sciences	1	22	3	26
Soil Sciences	--	2	--	2
Total	316	1,417	143	1,876

1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 39--1985-86 projected supply of graduates qualified for employment as Agricultural Production and Management Specialists[1]

Educational cluster	Baccalaureate	Master's	Total
Supply of Agriculture graduates:			
General Agriculture	43	3	46
Agricultural Business and Management	648	86	734
Agricultural Engineering	40	--	40
Agricultural Social Sciences	51	29	80
Animal Sciences	1,250	43	1,293
Natural Resources	246	--	246
Plant Sciences	851	55	906
Soil Sciences	233	--	233
Total	3,362	216	3,578
Supply of Agriculture-related graduates:			
Agricultural Business and Management	1,248	131	1,379
Agricultural Engineering	22	--	22
Agricultural Social Sciences	34	18	52
Animal Sciences	236	16	252
Natural Resources	6	--	6
Plant Sciences	27	3	30
Soil Sciences	2	--	2
Total	1,575	168	1,743

1. Based upon NCES projections as adjusted for the project. Projections are not available for the associate degree level.

Table 40--Detailed employment demand data for Agricultural Production and Management Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Farm labor supervisors	821	3,100	2,700	10.0	10.0	<400>	<44>	109	65
Farm management advisors[2]	024	1,250	1,092	100.0	100.0	<158>	<18>	26	8
Farm managers	802	20,000	31,200	80.0	80.0	11,200	1,244	1,147	2,391
Farm service laborers (self-employed)	824	1,000	1,100	10.0	10.0	100	11	42	53
Farmers (owners and tenants)	801	223,193	145,950	15.0	15.0	<77,243>	<8,583>	12,311	3,728

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1. Developed from OES national Census-based matrix data.
2. Excludes Cooperative Extension Service personnel, who are reported under the Occupational Cluster for Educators.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Agricultural Production and Management Specialists

1970 Census-of-population code	Census occupation	Examples of specific jobs
801	Farmer (owner and tenant)	Animal breeder Arboriculturist Cattle farmer Farm manager Fruit farmer Poultry farmer Rancher
821	Farm labor supervisor	Farm boss Farm supervisor Ranch supervisor
024	Farm management advisor	Farm consultant Farm management supervisor Feed advisor
802	Farm manager	Farm manager Greenhouse superintendent Herd manager Superintendent
824	Farm service labor (self-employed)	Contractor

Interpretation of Employment Opportunities for Agricultural Production and Management Specialists

Farming, ranching, and other related production industries (for example, nurseries and greenhouses) should afford significant employment opportunities for college graduates in agriculture and natural resources through the mid-1980's. However, it is anticipated that the trend will continue toward larger and more complex production units with adoption of labor-saving technology. If so, somewhat fewer farmers, ranchers, and production workers may be required in the 1980's as compared to the previous decade.

The intensification of animal production units, including more confined swine and cattle feeding operations, requires highly trained production managers. Also, the expanding size of production units, in general, and the introduction of more complex technology to farming and ranching increasingly require expertise gained through higher education in agriculture and natural resources.

Currently, between one-half and two-thirds of the students who enroll in agricultural colleges do not have a farm or ranch background or significant agricultural production experience. The strongest demand for agricultural production and management occupations in the 1980's should be for individuals with practical experience as well as academic credentials in the following fields:

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- Agricultural Mechanization
- Agriculture Production
- Agronomy
- Animal Sciences
- Dairy Management
- Farm and Ranch Management
- Horticulture and Ornamental Plants
- Poultry Management
- Range Management

Miscellaneous Agricultural Specialists
(Occupational Cluster #8)

Included in this cluster are a diverse group of professionals in food and agriculture with specific technical skills that are not accommodated by the preceding seven clusters. The kinds of technical expertise required of these workers vary widely.

Table 41--Supply of Agriculture graduates qualified for employment as Miscellaneous Agricultural Specialists[1]

	Associate[2]	Baccalaureate	Total[3]
Supply of Agriculture graduates:			
Current, 1976-77	1,478	1,311	2,789
Projected, 1985-86	NA	1,562	1,562
Average annual, 1976-86	NA	1,437	1,437
Supply of Agriculture-related graduates:			
Current, 1976-77	248	439	687
Projected, 1985-86	NA	491	491
Average annual, 1976-86	NA	465	465

1. Estimates represent summations of data in Tables 43 and 44.
2. Projections are not available (NA) for the associate degree level.
3. Associate degree recipients are included only in the "Current" total.

Table 42--Employment demand for Miscellaneous Agricultural Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1976 level of occupational employment[2]	Percentage of total 1976 occupational employment[3]	1976-85 estimated average annual openings
Animal caretakers (except farm)	39,963	34.7	2,675
Bakers	4,698	3.7	160
Farm implement mechanics	33,493	50.0	1,936
Food service workers, nec[4] (except private)	19,206	4.5	821
Inspectors, nec	3,099	2.1	0
Meat cutters and butchers (except manufacturing)	48,192	22.4	981
Produce graders and packers (except farm and factory)	13,856	46.0	728
Total	162,507		7,301

[1] Based on OES Census-based data; detailed data are shown in Table 45.

[2] Number of workers estimated as possessing higher education in food/agriculture.

[3] Percentage equals ratio of occupational employment estimated as possessing higher education in food/agriculture to total occupational employment.

[4] nec = not elsewhere classified.

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Table 43--1976-77 supply of graduates qualified for employment as Miscellaneous Agricultural Specialists[1]

Educational cluster	Associate	Baccalaureate	Total
Supply of Agriculture graduates:			
Agricultural Business and Management	11	180	191
Agricultural Engineering	325	--	325
Animal Sciences	280	200	480
Food Sciences	51	273	324
Natural Resources	369	494	863
Plant Sciences	442	164	606
Total	1,478	1,311	2,789
Supply of Agriculture-related graduates:			
Agricultural Business and Management	182	362	544
Agricultural Engineering	28	--	28
Animal Sciences	21	52	73
Food Sciences	--	5	5
Natural Resources	17	14	31
Plant Sciences	--	6	6
Total	248	439	687

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1. Based on 1976-77 HEGIS data as adjusted for purposes of the project.

Table 44--1985-86 projected supply of graduates qualified for employment as Miscellaneous Agricultural Specialists[1]

Educational cluster	Baccalaureate	Total
Supply of Agriculture graduates:		
Agricultural Business and Management	216	216
Animal Sciences	250	250
Food Sciences	254	254
Natural Resources	615	615
Plant Sciences	227	227
Total	1,562	1,562
Supply of Agriculture-related graduates:		
Agricultural Business and Management	416	416
Animal Sciences	47	47
Food Sciences	5	5
Natural Resources	16	16
Plant Sciences	7	7
Total	491	491

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[1] Based upon NCES projections as adjusted for the project. Projections are not available for the associate degree level.

Table 45--Detailed employment demand data for Miscellaneous Agricultural Specialists with higher education in the food and agricultural sciences[1]

Census occupation	1970 Census-of-population code	Number of workers with higher education in food and agriculture		Percentage of food and agricultural employment of total occupational employment		Employment growth (1976-85)	Average annual growth	Average annual replacement needs	Total average annual employment openings
		1976	1985	1976	1985				
Animal caretakers (except farm)	740	39,963	50,337	34.7	35.5	10,374	1,523	1,522	2,675
Bakers	403	4,698	4,613	3.7	3.7	<85>	<9>	169	160
Farm implement mechanics	480	33,493	40,998	50.0	50.0	7,505	834	1,102	1,936
Food service workers, nec[2] (except private)	916	19,206	19,687	4.5	3.7	481	53	768	821
Inspectors, nec[2]	452	3,099	1,963	2.1	1.2	<1,136>	<126>	84	<42>
Meat cutters and butchers (except manufacturing)	631	48,192	44,071	22.4	22.3	<4,121>	<548>	1,439	981
Produce graders and packers (except farm and factory)	625	13,856	15,325	46.0	46.4	1,469	163	565	728

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1. Developed from OES national Census-based matrix data.
2. nec = not elsewhere classified.

Examples of Specific Jobs Representative of Selected OES Census-Based Occupations Included in the Occupational Cluster for Miscellaneous Agricultural Specialists

1970 Census-of-population code	Census Occupation	Examples of specific jobs
740	Animal caretaker (except farm)	Animal caretaker Caretaker, animal shelter Gamekeeper Veterinarian's assistant Zoo keeper
402	Baker	Chef
480	Farm implement mechanic	Farm equipment assembler Farm equipment mechanic Irrigation equipment installer
916	Food service worker, nec[1] (except private household)	Culinary worker Food service supervisor
631	Meat cutter and butcher (except manufacturing)	Meat department manager Meat specialist Meat supervisor
625	Produce grader and packer (except factory and farm)	Egg grader Fruit inspector Grader Peanut grader Vegetable inspector

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[1] nec = not elsewhere classified.

Interpretation of Employment Opportunities for Miscellaneous Agricultural Specialists

The nature of this occupational employment category limits the demand for workers primarily to recipients of associate and baccalaureate degrees. Also, it should be noted that relationships between supply and demand are frequently more specific than those for the preceding seven clusters. For example, graduates with associate degrees in Agricultural Technology (included in the educational cluster for Agricultural Engineering) are qualified for employment as farm implement mechanics, but not as animal caretakers or bakers. Because of this, interpretation of the findings focuses more on specific types of occupations included in this cluster than on the employment cluster as a whole.

The largest annual employment demand is for 2,675 animal caretakers. However, this is a highly diverse type of occupational employment, and associate degree graduates are frequently as qualified as baccalaureate graduates. Furthermore, it is believed that presently there may exist numerous individuals with Animal/Biological Sciences associate and baccalaureate degrees who may strongly compete with new graduates for employment as animal caretakers.

The strongest employment demand in relationship to supply is that for farm implement mechanics. The data indicate that annually some 353 associate degree graduates are available to fill an estimated 1,936 job openings (Table 42).

The estimated demand for meat cutters (including meat specialists, meat supervisors, and meat department managers) exceeds supply by a sizable margin, as does the estimated demand for food service workers. Increased demand for convenience foods and for meals which are consumed outside of the home should continue to augment the need for associate and baccalaureate degree recipients in the food technology programs during the early 1980's. Increased interest in maintaining a high quality and nutritious food supply should sustain the need for graders and inspectors as food products move from producers to consumers.

While occupations associated with wildlife and recreation enterprises are not specifically identified in this employment aggregation, the present supply of qualified associate and baccalaureate graduates is believed to be ample. A depressed market for additional, new graduates may develop over the coming decade.

During the 1980's, the demand for Miscellaneous Agricultural Specialists should strongly correlate to levels of agricultural production. With some expansion of agricultural production anticipated, a continuing healthy demand for these workers also is expected.

CHAPTER III

Conclusions

Overview of Supply/Demand Relationships

Projected estimates through 1985 of supply/demand relationships for graduates of higher education in the food and agricultural sciences differ by occupational cluster. When total supply is related to total demand for each of the eight occupational clusters investigated in the study, shortages of qualified graduates appear to exist for five clusters: Scientific and Professional Specialists, Manufacturing and Processing Scientists and Engineers, Sales and Service Representatives and Purchasing Agents, Administrators/Managers/Financial Advisors, and Miscellaneous Agricultural Specialists. Supply approximates demand for one cluster, Agricultural Production and Management Specialists, and exceeds demand for two clusters, Media Specialists and Educators. However, with regard to Educators, it is important to note that, within the cluster, several supply deficiencies were identified.

As depicted in Chart 1, average annual employment demand exceeds average annual supply by the largest percentage factors for occupational clusters representative of Miscellaneous Agricultural Specialists, Administrators/Managers/Financial Advisors, and Manufacturing and Processing Scientists and Engineers. For these particular occupational clusters, demand exceeds supply by 50 percent, 30 percent, and 18 percent, respectively. These shortages suggest impending problems as the Nation strives to maintain adequate reserves of expertise in the food and agricultural sciences to complement labor force needs.

Examination of actual average annual numbers of graduates as compared to average annual job openings reveals that the largest shortages of workers are for those in the occupational clusters for Miscellaneous Agricultural Specialists, Administrators/Managers/Financial Advisors, Sales and Service Representatives and Purchasing Agents, and Scientific and Professional Specialists. Cumulatively, these four clusters suggest average annual shortages of some 8,500 qualified graduates. Therefore, these occupational clusters would seem to offer significant employment opportunities for graduates in food, agriculture, and natural resources.

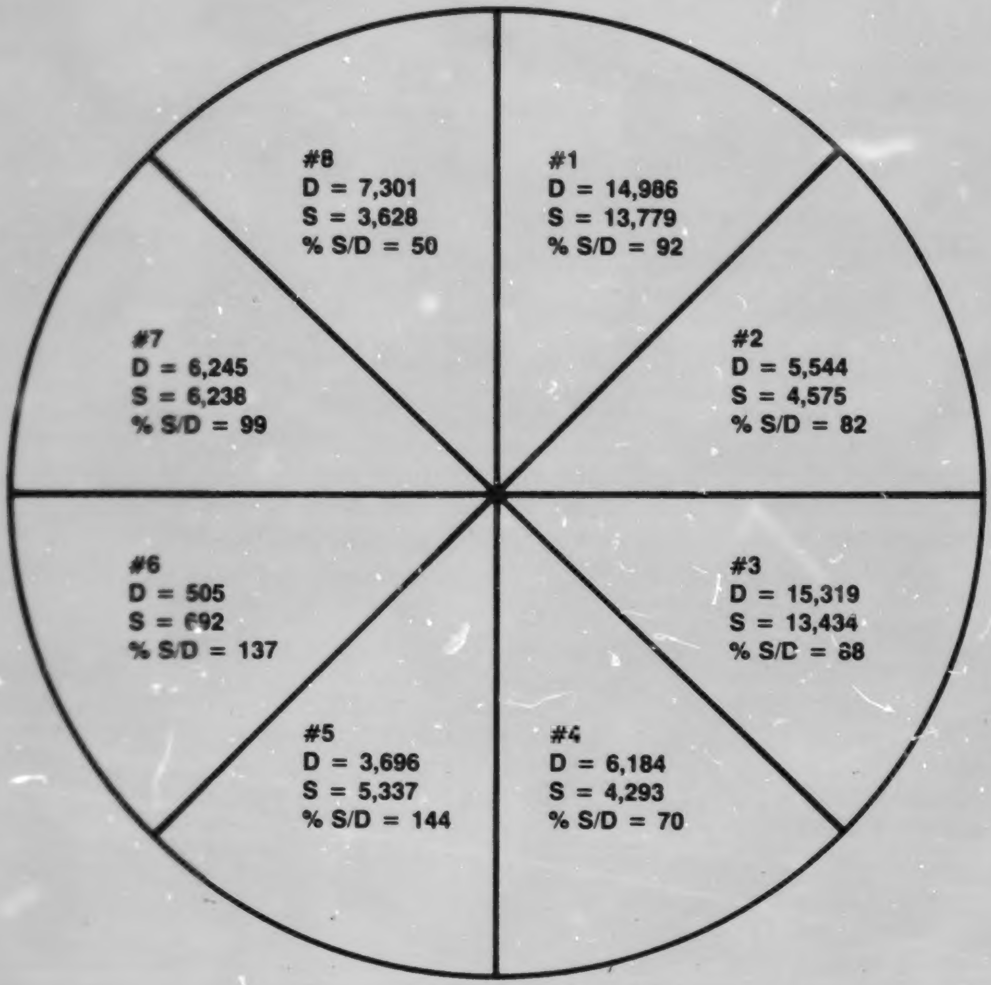
Supply/Demand Relationships by Degree Level and Type

Chart 2 summarizes supply/demand relationships by occupational cluster, degree type (agriculture and agriculture-related), and degree level (associate, baccalaureate, master's, doctoral, and D.V.M.). For example, within the Scientific and Professional Specialists (Occupational Cluster #1), the average annual number of agriculture degree recipients satisfies 75 percent of the demand; agriculture-related graduates satisfy approximately 15 percent of the demand. Of the agriculture degree recipients, baccalaureates satisfy 50 percent of the demand. Master's, doctoral, and D.V.M. recipients satisfy 25 percent of the demand.

Degree level and type requisite to occupational employment are empirical unknowns. Nevertheless, it seems important to assess the extent to which recipients of different types and levels of degrees are available to meet employment demand. To the extent that the methodological estimations underlying this study (for example, percentage distributions of graduates of the educational clusters among the occupational clusters) are accurate, these relationships are shown in Chart 2. As seen in the chart, associate degree graduates should be available through 1985 to fill approximately 10 percent, 20 percent, and 25 percent of employment demand for Sales and

Chart 1

Supply/Demand Relationships of Recipients of Agriculture and Agriculture-Related Degrees to Total Employment Demand, by Occupational Cluster, 1976-85.*



D = Demand
S = Supply

Occupational Clusters:

1. Scientific and Professional Specialists
2. Manufacturing and Processing Scientists and Engineers
3. Sales and Service Representatives and Purchasing Agents
4. Administrators, Managers, and Financial Advisors
5. Educators
6. Media Specialists
7. Agricultural Production and Management Specialists
8. Miscellaneous Agricultural Specialists

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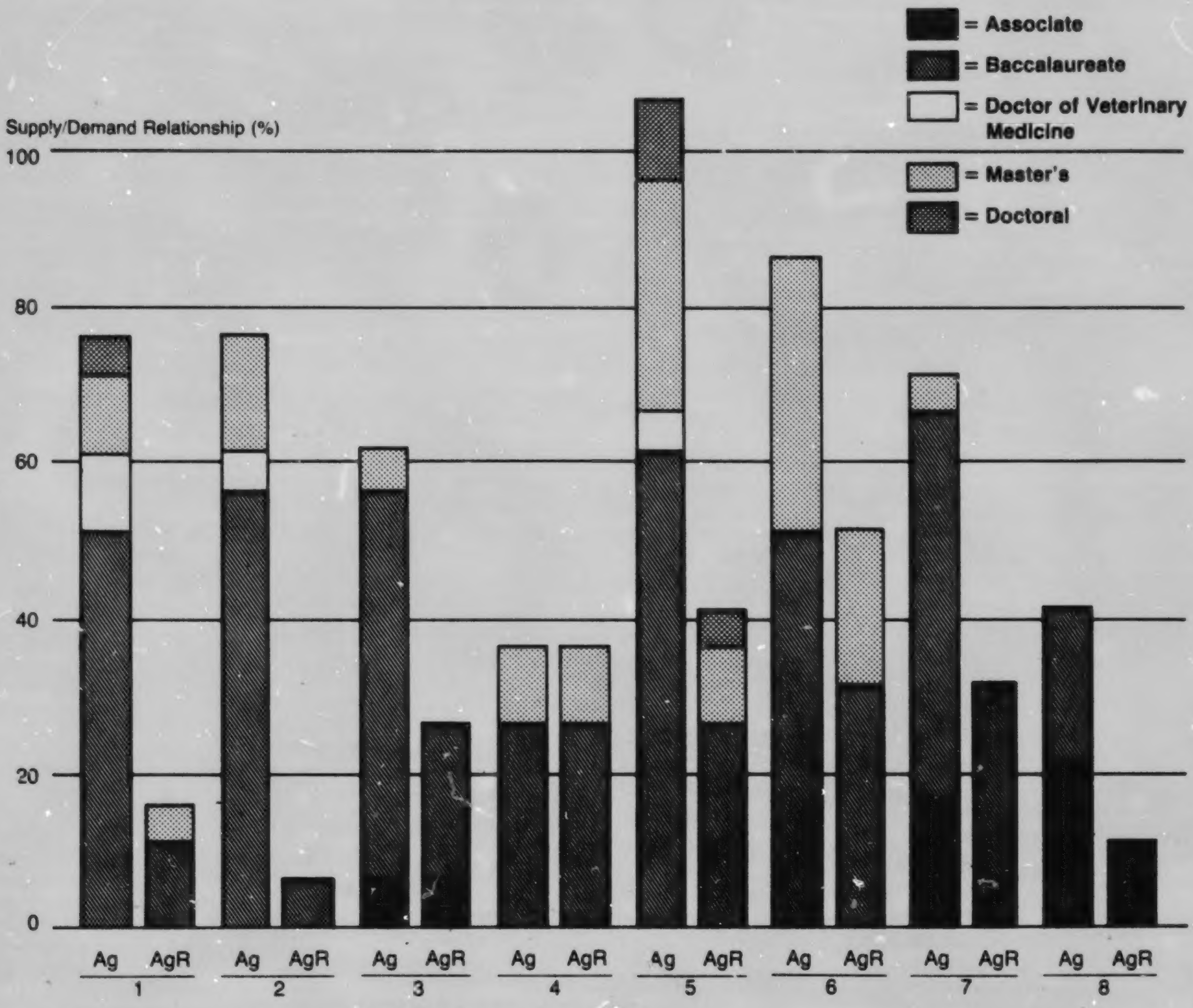
*Average annual supply expressed as a percentage of average annual demand from 1976 through 1985.

Chart 2

Relationship of the supply of recipients of Agriculture and Agriculture-related degrees to employment demand, by occupational cluster and degree level, 1976-1985, Associate to Graduate degrees.*



Occupational cluster and degree level, Agriculture and Agriculture-related degrees.

*Average annual supply expressed as percentage of average annual demand from 1976 through 1985. Because projections are unavailable for Associate degrees, 1976-77 supply data were used in lieu of average annual estimates for Associate-degree recipients.

Occupational Clusters:

1. Scientific and Professional Specialists.
2. Manufacturing and Processing Scientists and Engineers.
3. Sales and Service Representatives and Purchasing Agents.
4. Administrators, Managers, and Financial Advisers.
5. Educators.
6. Media Specialists.
7. Agricultural Production and Management Specialists.
8. Miscellaneous Agricultural Specialists.

Service Representatives and Purchasing Agents, Agricultural Production and Management Specialists, and Miscellaneous Agricultural Specialists.

The extent to which baccalaureate graduates should be available to fill employment demand ranges from 25 percent for Miscellaneous Agricultural Specialists (Occupational Cluster #8) to 85 percent for Educators (Occupational Cluster #5). With regard to employment demand for Educators, it is not practical to assume that baccalaureate graduates are qualified to fill 85 percent of all job openings (for example, college and university teaching positions). Furthermore, past history has shown that large numbers of these graduates are qualified for and elect career options other than education. As a result, many job openings in education remain unfilled on a continuing basis.

With the exception of employment demand relative to Miscellaneous Agricultural Specialists (Occupational Cluster #8) and Administrators, Managers, and Financial Advisors (Occupational Cluster #4), baccalaureate recipients should be available to fill at least 60 percent of average annual job openings in food and agriculture through 1985. In essence, substantial employment opportunities are projected for these graduates. Critical shortages of such graduates are not likely to become apparent through the mid-1980's, except for those specific degree specializations noted in the interpretations for some of the eight occupational clusters in Chapter II.

Advanced degree recipients should be available to satisfy from 6 percent to 58 percent of the demand for the various occupational clusters. This information is presented in greater detail in Chart 3. Considering the nature of the occupations within the eight occupational clusters, the adequacy of the supply of graduate degree recipients is questionable for several of the clusters.

Current and projected master's graduates would seem to be in short supply for employment demand related to Administrators, Managers, and Financial Advisors (S/D percent = 17), Manufacturing and Processing Scientists and Engineers (S/D percent = 14), Scientific and Professional Specialists (S/D percent = 10), and, perhaps, as related to Sales and Service Representatives and Purchasing Agents (S/D percent = 6). In order to strengthen the food/agriculture labor force, additional master's graduates appear to be needed in the following fields: Agricultural Business and Management, Agricultural Engineering, Animal Sciences, Food Sciences, Natural Resources, Plant Sciences, and Soil Sciences.

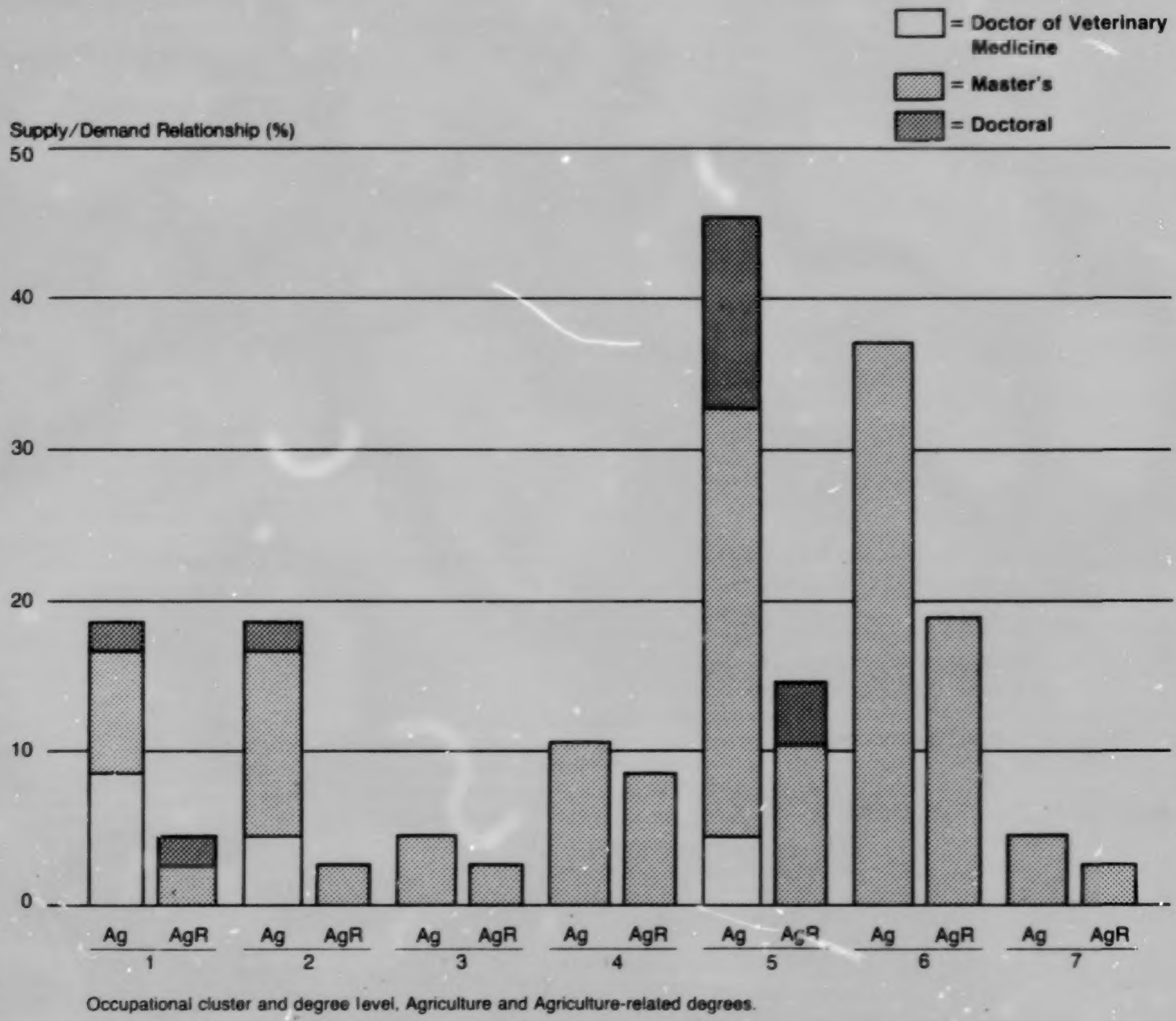
Annually through 1985, doctoral graduates are estimated to be in short supply for Administrators, Managers, and Financial Advisors (S/D percent = 1), Manufacturing and Processing Scientists and Engineers (S/D percent = 3), Scientific and Professional Specialists (S/D percent = 4), and Educators (S/D percent = 15).

Those educational backgrounds which appear to be especially needed at the doctoral level are as follows: Agricultural Business and Management, Agricultural Engineering, Animal Sciences, Food Sciences, Forest Engineering, Forest Products Utilization, Plant Sciences, and Soil Sciences.

Analysis of supply/demand relationships further suggests current/impending shortages of Doctor of Veterinary Medicine degree recipients relative to employment as Manufacturing and Processing Scientists and Engineers (biological research and regulatory medicine), and Educators (anatomy, internal medicine, microbiology, pathology, preventive medicine, and surgery).

Chart 3

Relationship of the supply of recipients of Agriculture and Agriculture-related degrees to employment demand, by occupational cluster and degree level, 1976-1985, Graduate degrees only.*



*Average annual supply expressed as percentage of average annual demand from 1976 through 1985. Advanced degrees were not deemed necessary for Occupational Cluster 8, Miscellaneous Agricultural Specialists.

Occupational Clusters:

1. Scientific and Professional Specialists.
2. Manufacturing and Processing Scientists and Engineers.
3. Sales and Service Representatives and Purchasing Agents.
4. Administrators, Managers, and Financial Advisers.
5. Educators.
6. Media Specialists.
7. Agricultural Production and Management Specialists.

Future Directions

This USDA study has entailed a comprehensive analysis of the supply of and demand for higher education graduates in the food and agricultural sciences. Because both educational and employment patterns are subject to change and because the methodology for this study relied heavily on expert opinion, future replications of labor supply/demand analyses need to be conducted on an ongoing basis. Such replications should serve to strengthen the methodology as well as to provide continually updated supply/demand statistics for purposes of educational planning.

Much has been accomplished in the conduct of this study toward establishing a model for future iterations. However, there are many possibilities for strengthening the research model, for improving data bases used in the analysis, and for examining special segments of the supply/demand population in greater detail. Briefly, this section addresses possible future directions for improving the technical quality and specificity of the information.

1. This initial study was constrained because of certain limitations in existing data sources that could not be overcome in the time frame during which the study was conducted. Future efforts should focus on correcting some of these limitations. For example:

    a. The Bureau of Labor Statistics Occupational Employment Statistics (OES) Program has not yet completed a national OES survey-based Industry-Occupation (I-O) Matrix. In lieu of a survey-based matrix, a Census-based matrix was used for the USDA study. In the future, however, an OES survey-based I-O matrix will be available for use, thus providing substantially more occupational and industrial detail than was possible by using the Census-based matrix.

    b. Currently, the OES survey program does not examine agriculture specific occupations and industries (e.g., farming and ranching). A study is currently being conducted for the National Occupational Information Coordinating Committee (NOICC) to determine alternative methods for including agriculture in the OES survey. Should the NOICC study result in feasible alternatives, cooperative efforts need to be initiated to encourage and enable BLS to expand the OES survey program to include coverage of specific agricultural occupations and industries.

    c. No existing data base presently accommodates comprehensive analysis of the labor force mobility of higher education graduates in food, agriculture, and natural resources. Longitudinal employment mobility information on these graduates needs to be acquired.

2. The use of expert opinion could be minimized in future studies if sound data bases were available pertaining to career placement of food/agriculture graduates and to educational backgrounds of workers in specific occupations/industries.

    a. The National Center for Education Statistics conducts a Survey of Recent College Graduates. These biennial surveys could be expanded to provide detailed information specific to the labor market experiences of higher education graduates in the food and agricultural sciences.

    b. Industry surveys of the educational backgrounds of workers could establish a data base on the actual percentage of workers in the occupations within the various industries who possess academic backgrounds in food/agriculture.

3. This initial study did not attempt to investigate special segments of the supply/demand population. Future endeavors could focus on greater specificity by identifying sex, racial, and ethnic characteristics of:

    a. food/agriculture graduates, and

    b. employees in food/agriculture-related positions.

Implementation of the foregoing suggestions would serve to strengthen future supply/demand analyses. As a result, educational planning, administration, and evaluation would have access to more precise, reliable information on which to base policy and action.

CHAPTER IV

Additional Information on Employment Demand for Food and Agriculture Graduates

International Employment Opportunities for Food and Agricultural Graduates

The demand for food and agricultural scientists extends beyond the borders of the United States. Furthermore, graduates of the U.S. agricultural system are held in high regard worldwide. For these reasons, international agricultural employment opportunities were considered also from the onset of the project. A first step in this endeavor was to access and review pertinent existing data. However, little information existed on international employment relative to food and agriculture. This prompted SEA to elicit the cooperation of the Foreign Agricultural Service, USDA, to collect data from U.S. agricultural counselors, attachés, and officers stationed in some 60 countries. Findings pertinent to data collection by the Foreign Agricultural Service and those stemming from the review of existing data are discussed in the two following sections.

Data Collected From Agricultural Counselors, Attachés, and Officers

In cooperation with the Foreign Agricultural Service, USDA, data were collected on international agricultural employment of U.S. citizens. For purposes of data collection, citizens were defined as individuals with a valid U.S.A. passport, 21 years of age or older, residing in and gainfully employed in a foreign country in a position for at least 1 year. Employment included positions with business and industry regardless of national origin of firm, the U.S. Federal Government, foreign governments/agencies, non-U.S.-based educational institutions, and self-employment.

U.S. agricultural counselors, attachés, and officers in 60 countries were asked to complete a questionnaire. The questionnaire was kept simple and brief. It was recognized that a simplistic methodology would not provide highly accurate data. However, the intent was to obtain indications of the magnitude of current/projected international employment and to identify those areas for which there appears to be the greatest demand for American specialists in food and agriculture.

A summary of the data collected is presented in Table 46; detailed data are presented in Appendix 23. The data show an increased demand for additional workers in all areas, with the exception of Plant Sciences, through 1985. Currently, the largest number of workers are in areas related to Agricultural Business and Management, Plant Sciences, Agricultural Education, Animal Sciences, and Natural Resources. Furthermore, these same areas, plus Agricultural Engineering, were cited most frequently as presently needing additional workers in order to meet current needs of the respective nations.

Projected employment demand for 1985 is such that those areas with the highest levels of employment are estimated to be Agricultural Business and Management, Agricultural Education, Agricultural Engineering, Natural Resources, Animal Sciences, and Plant Sciences. The most significant increments in employment projected through 1985 are for the fields of Agricultural Engineering, Agricultural Education, Natural Resources, and Food Sciences.

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Table 46--Summary of results of Foreign Agricultural Service survey[1]

Field of employment	Estimated number of U.S. citizens employed, 1979			Additional number of U.S. citizens needed to meet 1979 national needs	Estimated number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Agricultural Business and Management	267	109	376	110	428
Agricultural Education	90	94	184	127	269
Agricultural Engineering	52	36	88	70	224
Agricultural Social Sciences	24	19	43	30	83
Animal Sciences	117	62	179	44	205
Food Sciences	84	20	104	44	155
Natural Resources	88	63	151	49	217
Plant Sciences	132	85	217	70	199
Soil Sciences	65	25	91	32	103
Total	919	513	1,432	576	1,883

[1] Detailed data are presented in Appendix 23.

Review of Department of State Data

The Department of State develops an annual comprehensive listing of the number of civilian agency personnel under jurisdiction of diplomatic mission chiefs. Table 47 provides a summary of the December 31, 1978 listing.

As shown in Table 47, these data are helpful in assessing the scope of U.S. civilians working abroad under jurisdiction of the Federal Government. The data are categorized by agency and by geographic region, with information available by country. However, the data fail to indicate types of occupational employment (e.g., Agricultural Engineering, Dietetics/Nutrition, Forestry, Veterinary Medicine), nor do the data include U.S. citizens working abroad as non-Federal employees. Other than identifying numbers and locations of persons assigned to the U.S. Department of Agriculture, the data are of limited value in assessing labor force supply/demand relative to food and agriculture.

Review of 1970 Census Data

The publication, Americans Living Abroad,[10] which is based on the 1970 Census, presents data on U.S. citizens living abroad. Specifically, the publication encompasses those civilians who returned an Overseas Census Report and the crews of vessels who are counted on the Report of Military and Maritime Personnel as U.S. citizens or previous U.S. residents. In addition, spouses and children are included regardless of citizenship or previous residence.

As shown in Table 48, the 1970 employment level of Americans overseas (137,361) was relatively small. Overseas employment represented 0.2 percent of the 1970 labor force. The 137,361 workers were distributed among various occupations, though a high concentration were in the professional, technical, and kindred worker categories. Specifically, many of these workers were electrical or electronic engineers and religious workers. Data on detailed occupations related to food and agriculture are presented in Table 49.

Although 137,000 persons represent the employment count from the most comprehensive available data source, the figures are subject to response error and incomplete coverage since the enumeration of "other citizens" was conducted on a voluntary basis. Also, the data represent a point in time approximately 10 years ago. Changes in types of workers as well as changes in numbers of workers can be expected to have occurred over the 10-year period. Such changes are related to the political atmosphere and to general national and world economic and technological conditions. Even with historical data, it is very difficult to present a good planning forecast of Americans working abroad since world political conditions change constantly.

Persons in Food- and Agriculture-Related Positions in the Military

A comprehensive labor force supply/demand analysis must take into consideration military personnel. Therefore, data were requested and obtained from the Manpower Data Center, Department of Defense (DOD). The specific data accessed were those pertaining to the DOD occupational groups identified by the project consultants as likely to require higher education in the food and agricultural sciences. Table 50 presents the data for the selected occupational groups. Part I displays enlisted and military civilian personnel; Part II includes officers and military civilian personnel. As shown in the table, the military has substantial need for persons with food and agricultural expertise (for example, biological scientists, dietitians and nutrition officers, food inspectors, food service workers, foresters, landscape architects, soils engineers, and veterinarians).

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[10] Americans Living Abroad: 1970 U.S. Census of Population Subject Reports. Bureau of the Census, Social and Economic Statistics Administration, U.S. Department of Commerce.

Table 47--U.S. civilian agency personnel under jurisdiction of diplomatic mission chiefs, December 31, 1978[1,2]

Global summary	Total of all agencies	Agri- culture	Agency for International Development	Commerce	International Communications Agency	Justice	Peace Corps[3]	State	Transportation	Treasury	Other agencies[4]
Africa	4,214	10	736	—	205	--	2,549	782	3	4	7
Europe	3,054	76	33	28	269	178	--	1,788	67	199	221
East Asia, Pacific	3,576	34	443	9	176	78	1,788	838	24	30	29
Near East and South Asia	2,231	18	567	1	171	20	605	856	—	9	2
Latin America	3,054	138	538	19	218	145	2,184	1,031	6	51	46
Total	17,420	276	2,317	57	1,039	421	7,126	5,295	100	293	305

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1. Source: Department of State.
2. Excludes staffs of the Department of Defense and other elements, data on which are classified; also excludes personnel on staffs of international organizations.
3. Includes volunteers.
4. Other agencies: ABMC, ACDA, Energy, GSA, HHS (HEW), Interior, NASA, NSF, TVA, VA.

Table 48--1970 U.S. civilian population living and working abroad[1]

U.S. civilian employees abroad[2]	1970 level of employment
Federal civilian employees	56,448
Dependents of federal employees	
Armed forces (dependents)	8,134
Federal civilian employees (dependents)	2,779
Other U.S. citizen employees[3]	70,000

[1] Source: Americans Living Abroad: 1970 U.S. Census of Population Subject Reports. Bureau of the Census, Social and Economic Statistics Administration, U.S. Department of Commerce.

[2] Excludes U.S. citizens temporarily abroad on private business.

[3] Other U.S. citizens and their family members abroad for extended periods; coverage is incomplete since enumeration was on a voluntary basis.

Table 49--Selected detailed occupations of U.S. citizens employed abroad in Food/Agriculture-Related Positions[1]

Occupational category	1970 level of employment	
	Federal civilian employees	Other U.S. citizens employed abroad[2]
Agricultural and biological technicians (except health)	3	12
Agricultural scientists	412	148
Farmers, farm managers, and farm laborers	52	463
Registered nurses, dietitians, and therapists	816	1,640
Total	1,283	2,263

[1] Source: Americans Living Abroad: 1970 U.S. Census of Population Subject Reports. Bureau of the Census, Social and Economic Statistics Administration, U.S. Department of Commerce.

[2] Other U.S. citizens and their family members abroad for extended periods; coverage is incomplete since enumeration was on a voluntary basis.

Table 50--Food and agriculture workers in the military

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
Part I: Enlisted and military civilian personnel				
495	Firefighting and Damage Control	7,183	Army 51M	Fire fighter
			Navy XX9555	Repair party/unit leader
			Marines 7051	Aircraft crash, fire and rescue man
			8811	Fireman
			Air Force 571X0	Fire protection specialist
			Civilian GS 0081	Fire protection and prevention
321	Food Inspection and Veterinary Services	2,318	Army 91R	Veterinary specialist
			91T	Animal specialist
			Marine 8033	Veterinary technician
			Air Force 908X0	Veterinary specialist
			Civilian GS 0704	Animal health technician
800	Food Service, general	49,447	Army 00J	Club manager
			94B	Food service specialist
			94F	Hospital food service specialist
			Navy MS	Mess management specialist
			MS 3501-03	Mess management specialist
			MS 3525-26	Closed mess manager
			MS 3527-29	Wardroom/general mess supervisor
			MS 3531-33	Gallery/pantry watch captain
			MS 3534-35	Commissary store meat and produce department supervisor
			MS 3536-37	Commissary meat cutter
			XX9584	BEQ manager
			Marines 3381	Food service technician
			3311	Baker
			3371	Cook
			4132	Club manager/treasurer
			Air Force 612X0	Meat cutter
			61290	Supply services superintendent
			621X0	Baker
			622X0	Cook
			62270	Food service supervisor
			622X1	Diet therapy specialist

Table 50--Food and agriculture workers in the military--Continued

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
			Part I--Continued	
800	Food Service, general (con.)		Air Force 62291	Food service support
			Civilian GS-1144	Commissary store management
			Wage-74XX	Food preparing and serving
494	Nuclear, Biological, and Chemical Warfare	2,742	Army 54E	Chemical operations specialist
			Navy XX9598	Disaster control specialist
			Marines 5711	Nuclear, biological, and chemical defense specialist
			5712	Chemical technical escort
			Air Force 242X0	Disaster preparedness specialist
491	Physical Science Laboratory	437	Army 51G	Soils analyst
			Civilian GS-0458	Soil conservation technician
322	Preventive Medical Services	2,613	Army 91S	Environmental health specialist
			Air Force 907X0	Environmental health specialist
			Civilian GS-0698	Environmental health technician
			GS-1860	Public health inspection
			GS-1864	Public health quarantine inspection
801	Steward and Enlisted Aides	32,803	Marines 3372	Cook, specialist
			8915	Food service attendant
496	Other Technical Specialists and Assistants	256	Army OIC	Mechanical engineering assistant
			OID	Civil engineering assistant
			OIF	Physical sciences assistant
			OIG	Chemical engineering assistant

Table 50--Food and agriculture workers in the military--Continued

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
			Part I--Continued	
496	Other Technical Specialists and Assistants (con.)		Army OIH	Biological sciences assistant
			Air Force 99501	Engineer or scientific assistant
			Civilian GS-0021	Community planning technician
			GS-0119	Economics assistant
			GS-0404	Biological technician
			GS-0421	Plant pest control technician
			GS-0455	Range technician
			GS-0459	Irrigation system operation
			GS-0462	Forestry technician
			GS-0488	Fish hatchery management
			GS-0802	Engineer technician
			GS-0828	Construction analyst
			GS-1311	Physical science technician
			GS-1316	Hydrologic technician
			GS-1659	Fishery methods and equipment
			GS-1981	Agricultural commodity aid
			Part II: Officers and military civilian personnel	
6H	Allied Medical	3,259	Army commissioned-old 3316	Nutrition officer
			Army commissioned-new 65C	Hospital dietitian
			Navy 0875	Dietitian, therapeutic
			Air Force 9216	Dietitian
			Civilian GS-0630	Dietitian
5C	Biological Scientists	442	Army commissioned-old 3307	Microbiologist
			3310	Parasitologist
			3315	Entomologist
			Army commissioned-new 68A	Microbiologist
			68D	Parasitologist
			68G	Entomologist
			Navy 0841	Microbiologist
			0860	Entomologist

Table 50--Food and agriculture workers in the military--Continued

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
			Part II--Continued	
5C	Biological Scientists (con.)		Air Force 9136	Medical entomologist
			9156B	Biomedical lab officer microbiology
			9626	Scientist, medical/ biomedical
			Civilian GS-0401	General biological science
			GS-0403	Microbiology
			GS-0406	Agricultural extension
			GS-0408	Ecology
			GS-0410	Zoology
			GS-0413	Physiology
			GS-0414	Entomology
			GS-0430	Botany
			GS-0434	Plant pathology
			GS-0435	Plant physiology
			GS-0436	Plant quarantine and pest control
			GS-0437	Horticulture
			GS-0440	Genetics
			GS-0454	Range conservation
			GS-0457	Soil conservation
			GS-0460	Forestry
			GS-0470	Soil science
			GS-0471	Agronomy
			GS-0475	Agricultural management
			GS-0480	General fish and wildlife administration
			GS-0482	Fishing biology
			GS-0485	Wildlife refuge management
			GS-0486	Wildlife biology
			GS-0487	Husbandry
4K	Chemical	826	Army commissioned-old 7300	Chemical engineer
			7314	Chemical staff officer
			7315	Chemical combat service support officer
				Chemical officer
			Civilian GS-0893	Chemical engineering
4A	Construction and Utilities	3,591	Army 7902	Soils engineer
			Air Force 9116	Bio-environmental engineer, staff

Table 50--Food and agriculture workers in the military--Continued

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
			Part II--Continued	
4A	Construction and Utilities (con.)		Air Force 9124	Bio-environmental engineer
			Civilian GS-0807	Landscape architecture
8E	Food Service	750	Army commissioned-	
			old 4412	Club manager
			4414	Food manager
			Army commissioned-	
			new 43A	Club manager
			82A	Food management officer
			82C	Food advisor
			Army Warrant	
			021A	Club manager
			941A	Food service technician
			Navy 0814	Food service officer, medical facility
			1105	Mess treasurer
			1130	Food service officer
			1160	Food service administrator
			Marines 3302	Food services officer
			3310	Food services operations officer
			Air Force 6244	Food service officer
			Civilian GS-0120	Food assistance program specialists
5A	Physical Scientists	1,698	Army 3309	Biochemist
			7318	Organic chemist
			7319	Chemist
			7940	Geographer
			68C	Biochemist
			Navy 0840	Biochemist
			0843	Pharmacologist
			2090	Chemist
			Air Force 2645	Chemist/biologist
			Civilian GS-0150	Geography
			GS-0405	Pharmacology
			GS-1301	General physical science
			GS-1320	Chemistry
			GS-1350	Geology

Table 50--Food and agriculture workers in the military--Continued

DOD code	Occupation group	Number of workers 1979	Specific Food/Agriculture-related occupations within DOD group	
			Division/code	Occupation
			Part II--Continued	
6G	Veterinarians	666	Army commissioned-old 3200	General veterinary
			3201	Veterinary public officer
			3203	Veterinary staff officer
			3204	Veterinary food hygienic
			3205	Veterinary laboratory animal officer
			3206	Veterinary pathologist
			3207	Veterinary microbiologist/parasitologist
			3208	Veterinary radiobiologist/radiologist
			3209	Veterinary comparative medicine officer
			3210	Veterinary laboratory officer
			Army commissioned-new 64A	Veterinary services officer
			64B	Veterinary staff officer
			64C	Veterinary laboratory animal medicine officer
			64D	Veterinary pathologist
			64E	Veterinary microbiologist
			64F	Veterinary comparative medicine officer
			Air Force 9916	Staff veterinarian
			9925	Veterinarian
			9946	Veterinary clinical specialist
			9956	Veterinary health service specialist
8G	Other	46	Army commissioned-old 4942	Forestry officer

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APPENDIXES

Appendix 1. Supplementary data bases

1. Occupational employment information used to assess demand

	Data base	Description/source
a.	Federal Civilian Employment	Employment statistics for all Federal civilian employees are contained in the Central Personnel Data File (CPDF). Information from this source was used in the study to provide current employment statistics for Federal civilian occupations related to the food and agricultural sciences.
b.	Hired Farm Work Force	The Economics, Statistics, and Cooperatives Service (ESCS) of the U. S. Department of Agriculture collects information on the hired farm work force. Statistics indicate that approximately 10 percent of the hired farm work force have a 4-year college degree. These statistics were used as indicators of the percent of hired farm workers requiring a degree in the food and agricultural sciences.
c.	Employment in Higher Education Institutions	Clemson University was awarded a USDA-SEA grant to survey higher education institutions to determine current employment levels in college and university teaching and research positions in the food and agricultural sciences. The survey also collected information on unfilled positions, temporary faculty, and expected replacements because of retirements. This information was incorporated as employment statistics in the higher education component of the education employment sector.
d.	International Employment of Americans in the Food and Agricultural Sciences	A survey of Agriculture Counselors, Attachés, and Officers in 60 counties was coordinated through the USDA Foreign Agricultural Service. Results of the survey provide some indication of international employment opportunities for Americans.
e.	Defense Manpower	Information provided by the Defense Manpower Data Center was utilized to provide estimates of employment in military occupations related to the food and agricultural sciences.
f.	Cooperative Extension Service	USDA information on the educational, demographic, and occupational background of cooperative extension personnel was utilized to estimate the number of extension workers currently employed as agriculturists and to determine separation rates for estimating the replacement requirements for extension personnel.

Appendix 1. Supplementary data bases--Continued

g. Employment in Vocational Education	A 12-year summary prepared by the American Vocational Association provided data on the current supply of and demand for secondary teachers in the field of vocational agriculture. The summary indicates 1967-1978 employment levels, number of openings and the number of college graduates available to fill openings.

2. Higher education information used to assess supply

Data base	Description/source
a. Higher Education Enrollments in the Land-Grant Colleges	The Resident Instruction Committee on Organization and Policy (RICOP) of the National Association of State Universities and Land-Grant Colleges (NASULGC) conducts annual surveys of enrollments at member institutions in the following food and agriculture disciplines: (1) Animal Science (2) Plant/Soil Science (3) Social Science (4) Natural Resources (5) Related Sciences (6) General Agriculture (7) Other programs Information from these RICOP surveys was used to substantiate HEGIS information and as a basis for estimating placements of students receiving degrees in the food and agricultural sciences.
b. Enrollments of International Students in Food and Agriculture Sciences Degree Programs	The Institute of International Education conducts an annual survey of foreign students enrolled in American higher education institutions. Information from this survey will become available by late in 1980 and will subsequently be used to adjust the effective supply of higher education graduates qualified for jobs related to food and agriculture. This subsequent adjustment is important since less than 1 percent of these studies remain in the United States and participate in the American labor force.

3. Education placement information

Data base	Description/source
a. Survey of Recent College Graduates	Every 2 years the National Center for Education Statistics (NCES) conducts a placement survey of recent college graduates with baccalaureate and master's degrees. The results of the most recent placement survey were utilized in the analysis of the immediate labor force status of recent college graduates from food and agricultural-related disciplines. The use of these survey

a. Survey of Recent College Graduates--Continued	results was limited because (1) the sample of higher education institutions included in the survey is not adequately representative of colleges and universities with strong programs in food and agriculture, and (2) the degree areas of the graduates sampled do not provide adequate coverage of the food and agricultural sciences.
b. National Survey of Doctorate Recipients	This annual survey of all doctorate recipients is conducted by the National Academy of Sciences. Information from this survey was utilized to corroborate placement analyses.
c. Doctorate Records Files	A sample of doctoral recipients over a 42-year span is surveyed periodically by the National Academy of Sciences to determine current labor force status. Information from this survey was utilized to provide insight, of a longitudinal nature, regarding the occupational attachment of doctorates from the food and agricultural disciplines.
d. Recent Survey of Science and Engineering Graduates	This survey conducted by the National Science Foundation provides information on the labor force status of recent science and engineering graduates. The information from this survey was valuable but of limited use because of incompatibility in classification methods used in this and other surveys.

Appendix 2. Panel of consultants representing the Resident Instruction Section of the Division of Agriculture, National Association of State Universities and Land-Grant Colleges

Panel member	University
Stephen Chapman, Ph.D. Associate Dean and Director of Instruction College of Agricultural Sciences	Clemson University Clemson, South Carolina
J. Robert Cooke, Ph.D. Director of Resident Instruction College of Agriculture and Life Sciences	Cornell University Ithaca, New York
Ed Glazener, Ph.D. (Chairperson) Associate Dean and Director of Academic Affairs School of Agriculture and Life Sciences	North Carolina State University Raleigh, North Carolina
Allan Goecker, Ph.D. Assistant Dean School of Agriculture	Purdue University West Lafayette, Indiana
Richard Merritt, Ph.D. Dean of Instruction Cook College	Rutgers University New Brunswick, New Jersey
Winston E. Pullen, Ph.D. Associate Dean for Instruction College of Life Sciences and Agriculture	University of Maine Orono, Maine

Appendix 3. Degrees leading to expertise in Food and Agriculture and percentages of graduates deemed qualified for employment in Food/Agriculture Occupations[1]

Academic subdivisions based on HEGIS taxonomy	Percent of qualified graduates[2]		
	Baccalaureate level	Master's level	Doctoral level
0100 Agriculture and Natural Resources			
0101 Agriculture, general	100	100	100
0102 Agronomy (field crops and crop management)	100	100	100
0103 Soils science (management and conservation)	100	100	100
0104 Animal science (husbandry)	100	100	100
0105 Dairy science (husbandry)	100	100	100
0106 Poultry science	100	100	100
0107 Fish, game, and wildlife management	100	100	100
0108 Horticulture (fruit and vegetable production)	100	100	100
0109 Ornamental horticulture (floriculture, nursery science)	100	100	100
0110 Agricultural and farm management	100	100	100
0111 Agricultural economics	100	100	100
0112 Agricultural business	100	100	100
0113 Food science and technology	100	100	100
0114 Forestry	100	100	100
0115 Natural resources management	100	100	100
0116 Agriculture and forestry technologies	100	100	100
0117 Range management	100	100	100
0200 Architecture and Environmental Design			
0204 Landscape architecture	30	10	0
0206 City, community, and regional planning	10	20	20
0400 Biological Sciences			
0401 Biology, general	3	5	1
0402 Botany, general	5	10	5
0403 Bacteriology	1	5	5
0404 Plant pathology	100	100	100
0406 Plant physiology	50	50	75
0407 Zoology, general	3	5	1
0408 Pathology, human and animal	1	20	20
0409 Pharmacology, human and animal	1	10	10

See footnotes at end of appendix.

Appendix 3. Degrees leading to expertise in Food and Agriculture and Percentages of graduates deemed qualified for employment in Food/Agriculture Occupations--Continued

Academic subdivisions based on HEGIS taxonomy		Percent of qualified graduates[2]		
		Baccalaureate level	Master's level	Doctoral level
0400 Biological Sciences--Continued				
0410	Physiology, human and animal	1	2	20
0411	Microbiology	10	10	10
0412	Anatomy	--	1	1
0413	Histology	--	--	1
0414	Biochemistry	25	10	10
0416	Molecular biology	1	1	1
0417	Cell biology (cytology, cell physiology)	--	1	2
0418	Marine biology	15	15	15
0419	Biometrics and biostatistics	--	15	25
0420	Ecology	1	10	10
0421	Entomology	80	75	50
0422	Genetics	1	10	30
0423	Radiobiology	--	--	5
0424	Nutrition, scientific (excludes Nutrition in home economics and dietetics)	100	100	100
0425	Neurosciences	--	--	5
0426	Toxicology	--	5	10
0427	Embryology	--	--	5
0500 Business and Management				
0501	Business and commerce, general	5	1	1
0502	Accounting	5	1	1
0503	Business statistics	3	1	1
0504	Banking and finance	5	1	1
0505	Investments and securities	3	1	1
0506	Business management and administration	2	2	2
0507	Operations research	1	1	1
0508	Hotel and restaurant management	5	1	--
0509	Marketing and purchasing	10	10	20
0510	Transportation and public utilities	2	1	--
0511	Real estate	5	--	--
0512	Insurance	1	5	2
0513	International business	1	5	2
0515	Personnel management	5	3	--
0516	Labor and industrial relations	5	3	1
0517	Business economics	10	10	20

Appendix 3. Degress leading to expertise in Food and Agriculture and Percentages of graduates deemed qualified for employment in Food/Agriculture Occupations--Continued

Academic subdivisions based on HEGIS taxonomy	Percent of qualified graduates[2]		
	Baccalaureate level	Master's level	Doctoral level
0600 Communications			
0601 Communications, general	1	1	--
0602 Journalism (printed media)	2	2	--
0603 Radio/television	1	1	--
0604 Advertising	1	1	--
0605 Communication media (use of videotape, films, and so forth, oriented specifically toward radio/television)	1	1	--
0700 Computer and Information Sciences			
0701 Computer and information sciences, general	1	1	1
0702 Information sciences and systems	1	1	1
0703 Data processing	1	--	--
0705 Systems analysis	1	2	2
0800 Education			
0899-1 Other: Agricultural Education	100	100	100
0900 Engineering			
0903 Agricultural engineering	100	100	100
0905 Bioengineering and biomedical engineering	1	2	2
0906 Chemical engineering (includes petroleum refining)	1	1	1
0908 Civil, construction, and transportation engineering	1	1	--
0909 Electrical, electronics, and communications engineering	1	1	--
0911 Geological engineering	1	1	1
0912 Geophysical engineering	1	1	1
0913 Industrial and management engineering	2	2	--
0922 Environmental and sanitary engineering	5	2	--
0923 Naval architecture and marine engineering	1	1	--

Appendix 3. Degrees leading to expertise in Food and Agriculture and Percentages of graduates deemed qualified for employment in Food/Agriculture Occupations--Continued

Academic subdivisions based on HEGIS taxonomy	Percent of qualified graduates[2]		
	Baccalaureate level	Master's level	Doctoral level
1200 Health Professions			
1218 Veterinary medicine (D.V.M. degree)	--	--	100
1219 Veterinary medicine specialties (work beyond first-professional degree, D.V.M.)	--	--	30
1223 Medical laboratory technologies	1	2	--
1300 Home Economics			
1306 Foods and nutrition	100	100	100
1307 Institutional management and cafeteria management	100	100	100
1700 Mathematics			
1702 Statistics, mathematical and theoretical	1	1	1
1900 Physical Sciences			
1907 Organic chemistry	--	--	1
1909 Analytical chemistry	1	1	1
1910 Pharmaceutical chemistry	--	1	1
1913 Atmospheric sciences and meteorology	--	1	1
1914 Geology	1	2	1
1917 Earth sciences, general	1	2	1
1919 Oceanography	1	1	1
2000 Psychology			
2005 Social psychology	1	1	1
2100 Public Affairs and Services			
2103 Parks and recreation management	50	40	--
2106 International public service (other than diplomatic service)	1	1	--
2200 Social Sciences			
2204 Economics	2	2	2
2206 Geography	--	1	1

Appendix 3. Degrees leading to expertise in Food and Agriculture and Percentages of graduates deemed qualified for employment in Food/Agriculture Occupations--Continued

Academic subdivisions based on HEGIS taxonomy	Percent of qualified graduates[2]		
	Baccalaureate level	Master's level	Doctoral level
2200 Social Sciences--Continued			
2208 Sociology	2	2	1
2210 International relations	1	1	--
4900 Interdisciplinary Studies			
4901 General liberal arts and sciences	1	1	--
4902 Biological and physical sciences	1	1	--
4903 Humanities and social sciences	1	1	--
4904 Engineering and other disciplines	1	1	--

	Associate level
5000 Business and Commerce Technologies	
5001 Business and commerce technologies, general	5
5004 Marketing, distribution, purchasing, business, and industrial management technologies	5
5010 Hotel and restaurant management technologies	5
5011 Transportation and public utilities technologies	1
5100 Data Processing Technologies	
5101 Data processing technologies, general	1
5200 Health Services and Paramedical Technologies	
5205 Medical or biological laboratory assistant technologies	3
5206 Animal laboratory assistant technologies	10
5207 Radiologic technologies (X-ray and so forth)	1
5211 Surgical technologies	1
5218 Institutional management technologies (rest home and so forth)	5
5300 Mechanical and Engineering Technologies	
5304 Architectural drafting technologies	1
5309 Civil technologies (surveying photogrammetry and so forth)	3

Appendix 3. Degrees leading to expertise in Food and Agriculture and Percentages of graduates deemed qualified for employment in Food/Agriculture Occupations--Continued

Academic subdivisions based on HEGIS taxonomy		Percent of qualified graduates[2]
		Associate level
5400 Natural Science Technologies		
5402	Agriculture technologies (includes horticulture)	100
5403	Forestry and wildlife technologies (includes fisheries)	100
5404	Food services technologies	25
5406	Marine and oceanographic technologies	20
5407	Laboratory technologies, general	5
5408	Sanitation and public health inspection technologies (environmental health technologies)	10

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1. Huff, Robert A., and Chandler, Marjorie O., A Taxonomy of Instructional Programs in Higher Education, National Center for Education Statistics, Department of Health, Education, and Welfare, U.S. Government Printing Office, Washington, D.C., 1970.

2. Percentages reflect expert opinion of the panel of consultants and are assumed valid through 1985.

Appendix 4. Assignment of HEGIS degree specializations to educational clusters

Initially, HEGIS degrees which lead to expertise in the food and agriculture sciences were selected (Appendix 3). Subsequently, the following 11 educational clusters were established for the purpose of categorizing agriculture and agriculture-related degrees according to educational emphasis. In instances when a given degree leads to expertise in multiple clusters, selected percentages of the graduates were assigned to the appropriate clusters.

General Agriculture (Educational cluster #1)

Agricultural Degrees

0101 General agriculture

Agriculture-Related Degrees

(Not applicable)

Agricultural Business and Management (Educational cluster #2)

Agricultural Degrees

0110 Agricultural and farm management
0111 Agricultural economics
0112 Agricultural business

0508 Hotel and restaurant management

1307 Institutional management and cafeteria management

5010 Hotel and restaurant management technologies

5218 Institutional management technologies (rest homes and so forth)

Agriculture-Related Degrees

0501 Business and commerce, general
0502 Accounting
0503 Business statistics
0504 Banking and finance
0505 Investments and securities
0506 Business management and administration
0507 Operations research
0509 Marketing and purchasing

0510 Transportation and public utilities
0511 Real estate
0512 Insurance
0513 International business
0515 Personnel management
0516 Labor and industrial relations
0517 Business economics

0419 Biometrics and biostatistics

0701 Computer and information sciences, general
0702 Information sciences and systems
0703 Data processing
0705 Systems analysis

1702 Statistics, mathematical and theoretical

2204 Economics

5001 Business and commerce technologies, general
5004 Marketing, distribution, purchasing, business, and industrial management technologies

Appendix 4--Continued

Agricultural Business and Management (Educational cluster #2)--Continued

Agricultural Degrees

Agriculture-Related Degrees

5011 Transportation/public utilities technologies
5101 Data processing technologies, general

5408 Sanitation and public health inspection technologies (environmental health technologies)

Agricultural Engineering (Educational cluster #3)

Agricultural Degrees

0903 Agricultural engineering

5402 Agriculture technologies (20 percent)

Agriculture-Related Degrees

0905 Bioengineering and biomedical engineering
0906 Chemical engineering (includes petroleum refining)
0908 Civil, construction, and transportation engineering
0909 Electrical engineering
0911 Geological engineering
0912 Geophysical engineering
0913 Industrial and management engineering
0922 Environmental and sanitary engineering
0923 Naval architecture and marine engineering

4904 Engineering and other disciplines

5304 Architectural drafting technologies
5309 Civil technologies

Agriculture-Related Sciences (Educational cluster #4)

Agricultural Degrees

(Not applicable)

Agriculture-Related Degrees

0411 Microbiology
0413 Histology
0414 Biochemistry
0416 Molecular biology
1907 Organic chemistry
1908 Analytical chemistry
1914 Geology (90 percent)

Agricultural Social Sciences (Educational cluster #5)

Agricultural Degrees

0899-1	Agricultural education

Agriculture-Related Degrees

0206	City, community, and regional planning
0601	Communications, general
0602	Journalism (printed media)
0603	Radio, television
0604	Advertising
0605	Communication media
2005	Social psychology
2206	Geography
2208	Sociology
4901	General liberal arts and sciences
4903	Humanities and social sciences

Animal Sciences (Educational cluster #6)

Agricultural Degrees

0104	Animal science (husbandry)
0105	Dairy science (husbandry)
0106	Poultry science
1218	Veterinary medicine (D.V.M.)
1219	Veterinarian medicine specialty
1223	Medical laboratory technologies
5206	Animal laboratory assistant technologies
5402	Agricultural technologies (30 percent)

Agriculture-Related Degrees

0401	Biology, general (70 percent)
0407	Zoology
0408	Pathology, human and animal
0409	Pharmacology, human and animal
0410	Physiology, human and animal
0412	Anatomy
0417	Cell biology (50 percent)
0421	Entomology (80 percent)
0422	Genetics (50 percent)
0423	Radiobiology
0425	Neurosciences
0426	Toxicology (80 percent)
0427	Embryology
1910	Pharmaceutical chemistry
4902	Biological and physical sciences (70 percent)
5205	Medical or biological laboratory assistant technologies
5206	Animal laboratory assistant technologies
5207	Radiologic technologies (X-ray and so forth)
5211	Surgical technologies
5407	Lab technology, general (25 percent)

Appendix 4--Continued

Food Sciences (Educational cluster #7)

Agricultural Degrees

0113	Food science and technology
0424	Nutrition, scientific
1306	Foods and nutrition (includes dietetics)
5404	Food services technologies

Agriculture-Related Degrees

0401	Biology, general (10 percent)
0403	Bacteriology
4902	Biological and physical sciences (10 percent)
5407	Lab technology, general (25) percent)

International Agriculture (Educational cluster #8)

Agricultural Degrees

(Not applicable)

Agriculture-Related Degrees

2106	International public service
2210	International relations

Natural Resources (Educational cluster #9)

Agricultural Degrees

0107	Fish, game, and wildlife management
0114	Forestry
0115	Natural resources management
0116	Agriculture and forestry technologies
0117	Range management (20 percent)
2103	Park and recreation management
5403	Forestries and wildlife technologies (includes fisheries)

Agriculture-Related Degrees

0401	Biology, general (10 percent)
0418	Marine biology
0420	Ecology
1913	Atmospheric sciences and meteorology
1914	Geology (10 percent)
1919	Oceanography
4902	Biological and physical sciences (10 percent)
5406	Marine and oceanographic technologies

Plant Sciences (Educational cluster #10)

Agricultural Degrees

0102	Agronomy (60 percent)
0108	Horticulture (fruit and vegetable production)
0109	Ornamental horticulture
0117	Range management (80 percent)
0204	Landscape architecture
0402	Botany
0404	Plant pathology
0406	Plant physiology
5402	Agriculture technologies (50 percent)

Agriculture-Related Degrees

0401	Biology, general (10 percent)
0417	Cell biology (50 percent)
0421	Entomology (20 percent)
0422	Genetics (50 percent)
0426	Toxicology (20 percent)
4902	Biological/physical sciences (10 percent)
5407	Lab technology, general (25 percent)

Soil Sciences (Educational cluster #11)

Agricultural Degrees

0102	Agronomy (40 percent)
0103	Soils science (management and conservation)

Agriculture-Related Degrees

1917	Earth sciences, general
5407	Laboratory technology, general (25 percent)

Appendix 5-1--Associate Agriculture degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	--	--	--	37	37	--	--	--	16	16	--	--	--	53	53
Agricultural Engineering	24	24	45	415	460	11	1	16	114	130	32	29	61	529	590
Agricultural-Related Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Social Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Animal Sciences	32	35	67	628	695	16	8	24	216	240	48	43	91	843	934
Food Sciences	2	--	2	82	84	1	--	1	61	62	3	--	3	143	146
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	--	--	--	1303	1303	--	--	--	174	174	--	--	--	53	53
Plant Sciences	54	59	113	1037	1150	27	13	40	284	324	81	72	91	843	934
Soil Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	109	118	227	3502	3729	55	26	81	865	946	164	144	308	4366	4674

Appendix 5-2--Associate Agriculture-related degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	--	--	--	648	648	--	--	--	263	263	--	--	--	911	911
Agricultural Engineering	1	--	1	46	47	--	--	--	4	4	1	--	1	50	51
Agricultural-Related Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Social Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Animal Sciences	14	--	14	--	14	60	--	60	--	60	74	--	74	--	74
Food Sciences															
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	--	--	--	58	58	--	--	--	10	10	--	--	--	68	68
Plant Sciences	--	--	--	1	1	--	--	--	--	--	--	--	--	1	1
Soil Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	14	--	14	753	767	60	--	60	278	339	75	--	75	1031	1106

Appendix 5-3--Baccalaureate Agriculture degrees: Tabulations of 1976-77 HECIS degrees by educational cluster, institution type, and sex of student

	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
Educational cluster	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	23	1	24	54	78	5	--	5	9	14	28	1	29	63	92
Agricultural Business and Management	1745	50	1795	1127	2922	295	4	299	384	683	2040	54	2094	1511	3605
Agricultural Engineering	343	2	345	137	482	17	--	17	5	22	360	2	362	142	504
Agricultural-Related Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Social Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1697*
Animal Sciences	2263	84	2347	1112	3459	1051	32	1083	449	1532	3314	116	3430	1561	4991
Food Sciences	387	19	406	331	737	1705	58	1763	2963	4727	2092	77	2169	3294	5463
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	3806	172	3978	3406	7384	994	43	1037	1456	2493	4799	215	5014	4862	9876
Plant Sciences	1777	75	1852	920	2772	928	27	955	366	1321	2705	102	2807	1286	4093
Soil Sciences	593	39	632	343	975	159	2	161	42	203	752	42	794	384	1178
Total	10937	442	11379	7430	18809	5153	166	5319	5674	10994	16090	608	16693	13104	31499

*Based on data from the American Vocational Association.

Appendix 5-4--Baccalaureate Agriculture-related degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
Educational cluster	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	873	27	900	4648	5548	280	14	294	1402	1696	1153	41	1194	6050	7244
Agricultural Engineering	64	3	67	108	175	7	--	7	8	15	71	3	74	116	190
Agricultural-Related Sciences	294	5	299	706	1005	135	4	139	393	532	429	9	438	1099	1537
Agricultural Social Sciences	88	3	91	395	486	97	4	101	445	546	185	7	192	840	1032
Animal Sciences	259	6	265	593	858	101	4	105	329	434	359	11	370	922	1292
Food Sciences	12	--	12	53	65	7	1	8	32	40	19	1	20	85	190
International Agriculture	1	--	1	7	8	1	--	1	3	4	2	--	2	10	12
Natural Resources	32	1	33	174	207	11	1	12	68	80	44	1	45	242	287
Plant Sciences	37	1	38	61	99	12	1	13	32	45	50	1	51	93	144
Soil Sciences	2	--	2	7	9	1	--	1	2	3	3	--	3	9	12
Total	1662	46	1708	6752	8460	652	29	681	2714	3395	2315	74	2389	9466	11855

Appendix 5-5--Master's Agriculture degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	1	1	2	4	6	--	--	--	--	--	1	1	2	4	6
Agricultural Business and Management	426	5	431	125	556	58	1	59	57	116	484	6	490	182	672
Agricultural Engineering	103	--	103	27	130	3	--	3	--	3	106	--	106	27	133
Agricultural-Related Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Social Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	848*
Animal Sciences	394	14	408	107	515	67	1	68	23	91	461	15	476	130	606
Food Sciences	196	9	205	109	314	362	6	368	699	1067	558	15	573	808	1381
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	624	20	644	516	1160	86	5	91	137	228	710	25	735	653	1388
Plant Sciences	546	19	565	135	700	142	3	145	35	180	688	22	710	170	880
Soil Sciences	219	12	231	56	287	26	--	26	4	30	244	12	256	61	317
Total	2509	80	2589	1079	3668	744	16	760	955	1715	3252	96	3348	2035	6231

*Estimated by panel of consultants.

Appendix 5-6--Master's Agriculture-related degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	11	2	113	803	916	27	--	27	144	171	138	2	140	947	1087
Agricultural Engineering	30	--	30	70	100	1	--	1	3	4	31	--	31	73	104
Agricultural-Related Sciences	30	--	30	39	69	16	--	16	21	37	46	--	46	60	106
Agricultural Social Sciences	60	--	60	182	242	26	--	26	88	114	86	--	86	270	356
Animal Sciences	36	3	39	137	176	15	1	16	65	81	51	4	55	202	257
Food Sciences	2	--	2	12	14	1	--	1	5	6	3	--	3	17	20
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	11	--	11	33	44	4	--	4	10	14	15	--	15	43	58
Plant Sciences	30	--	31	15	46	7	--	7	8	15	37	1	38	23	61
Soil Sciences	1	--	1	1	2	--	--	--	1	1	1	--	1	2	3
Total	311	6	317	1292	1609	96	2	98	346	443	409	6	415	1637	2052

Appendix 5-7--Doctoral Agriculture degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	123	--	123	15	138	5	--	5	3	8	128	--	128	18	146
Agricultural Engineering	21	--	21	2	23	--	--	--	--	--	21	--	21	2	23
Agricultural-Related Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Social Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	33*
Animal Sciences	125	--	125	16	141	9	--	9	2	11	134	--	134	18	152
Food Sciences	89	3	92	61	153	46	--	46	38	84	135	3	138	99	237
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	139	--	139	45	184	5	--	5	3	8	144	--	144	48	192
Plant Sciences	227	9	236	33	269	23	--	23	9	32	250	9	259	42	301
Soil Sciences	96	5	102	13	115	2	--	2	1	3	98	5	103	15	118
Total	820	17	837	186	1023	90	--	90	56	146	910	17	927	242	1202

*"Summary Report of 1978: Doctorate Recipients from the United States Universities, National Research Council, National Academy of Sciences," p. 27, 1979.

Appendix 5-8--Doctoral Agriculture-related degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
General Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Business and Management	16	--	16	16	32	1	--	1	1	2	17	--	17	17	34
Agricultural Engineering	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural-Related Sciences	32	--	32	53	85	6	--	6	20	26	38	--	38	73	111
Agricultural Social Sciences	6	--	6	6	12	1	--	1	1	2	7	--	7	7	14
Animal Sciences	82	1	83	66	149	16	--	16	16	32	98	1	99	82	181
Food Sciences	1	--	1	--	1	--	--	--	--	--	1	--	1	--	1
International Agriculture	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Natural Resources	6	--	6	6	12	1	--	1	1	2	7	--	7	7	14
Plant Sciences	20	--	20	8	28	4	--	4	4	8	23	--	23	13	36
Soil Sciences	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	163	1	164	158	322	28	--	28	42	70	190	1	191	201	392

Appendix 5-9--Doctor of Veterinary Medicine degrees: Tabulations of 1976-77 HEGIS degrees by educational cluster, institution type, and sex of student

Educational cluster	MEN					WOMEN					TOTAL				
	Type of institution					Type of institution					Type of institution				
	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total	1862 land-grant	1890 land-grant	All land-grant	Non-land-grant	Total
1218 Veterinary Medicine	1055	--	1055	169	1224	310	--	310	52	362	1365	--	1365	221	1586

Appendix 6. Summary of total supply of 1976-77 graduates in the Food and Agricultural Sciences classified by educational cluster and degree level

Education cluster	Agriculture degrees				Total	Agriculture-related degrees				Total	Total
	Associate	Baccalaureate	Master's	Doctoral		Associate	Baccalaureate	Master's	Doctoral		
General Agriculture	--	92	6	--	98	--	--	--	--	--	98
Agricultural Business and Management	53	3,605	672	146	4,476	911	7,244	1,087	34	9,276	13,752
Agricultural Engineering	590	504	133	23	1,250	51	190	104	--	345	1,595
Agricultural-Related Sciences	--	--	--	--	--	--	1,537	106	111	1,754	1,754
Agricultural Social Sciences	--	1,697*	848*	33*	2,578	--	1,032	356	14	1,402	3,980
Animal Sciences	934	4,991	606	152	6,683	74	1,293	257	181	1,805	8,448
Food Sciences	146	5,463	1,381	237	7,227	1	105	20	1	127	7,354
International Agriculture	--	--	--	--	--	--	12	--	--	12	12
Natural Resources	1,477	9,877	1,388	192	12,934	68	287	58	15	428	13,362
Plant Sciences	1,474	4,093	880	301	6,748	1	144	61	36	242	6,990
Soil Sciences	--	1,178	317	118	1,613	--	12	3	--	15	1,628
Total	4,674	31,500	6,231	1,202	43,607	1,106	11,856	2,052	392	15,406	59,013**

*Baccalaureate data from the American Vocational Association; Master's data based on estimates by panel of consultants; Doctoral data from National Research Council, NAS.

**Does not include 1,586 Doctor of Veterinary Medicine degrees.

Appendix 7. Percentage of HEGIS general degrees estimated by panel of consultants as legitimate generalist degrees

HEGIS code	Academic subdivision	Degree level		
		Baccalaureate	Master's	Doctoral
			Percent	
0101	Agriculture, general	5	2	0
0201	Environmental design, general	80	80	0
0401	Biology, general	80	100	0
0402	Botany, general	100	90	80
0407	Zoology, general	100	90	80
0501	Business and commerce, general	80	50	20
0601	Communications, general	100	90	90
0701	Computer and information services, general	100	100	100
0901	Engineering, general	90	0	0
1201	Health professions, general	90	90	90
1301	Home economics, general	10	2	0
1701	Mathematics, general	100	100	100
1901	Physical sciences, general	100	90	80
1902	Physics, general	100	90	80
1905	Chemistry, general	100	90	80
2001	Psychology, general	100	70	60
2101	Community services, general	100	100	100
2201	Social sciences, general	100	100	100
4901	General liberal arts and sciences	100	100	100

Appendix 8. Summary comparison of Agriculture and Agriculture-related graduates of all institutions in 1976-77 and projections for 1985 classified by educational cluster and degree level

Educational cluster	Baccalaureate		Master's		Doctorate		Total	
	1976	1985	1976	1985	1976	1985	1976	1985
General Agriculture								
Agriculture degrees	92	107	6	9	--	00	98	116
Agricultural Business								
Agriculture degrees	3,605	4,320	672	858	146	186	4,423	4,364
Agriculture-related degrees	7,244	8,321	1,087	1,314	34	63	8,365	9,698
Agricultural Engineering								
Agriculture degrees	504	800	133	186	23	68	660	1,054
Agriculture-related degrees	190	439	104	169	--	5	294	613
Agriculture-Related Sciences								
Agriculture-related degrees	1,537	1,580	106	120	111	106	1,754	1,806
Agricultural Social Sciences								
Agriculture degrees	1,697	1,700	848	470	33	5	2,578	2,291
Agriculture-related degrees	1,032	1,147	356	356	14	20	1,402	1,523
Animal Sciences								
Agriculture degrees	4,991	6,251	606	854	152*	176**	5,749*	7,281**
Agriculture-related degrees	1,293	1,179	257	328	181	177	1,731	1,684
Food Sciences								
Agriculture degrees	5,463	5,082	1,381	1,589	237	256	7,081	6,927
Agriculture-related degrees	105	105	20	21	1	1	126	127
International Agriculture								
Agriculture degrees	--	--	--	--	--	--	--	--
Agriculture-related degrees	12	19	--	--	--	--	12	19
Natural Resources								
Agriculture degrees	9,877	12,303	1,388	1,684	192	244	11,457	14,231
Agriculture-related degrees	287	323	58	72	15	18	360	413
Plant Sciences								
Agriculture degrees	4,093	5,671	880	1,109	301	346	5,274	7,126
Agriculture-related degrees	144	181	61	61	36	34	241	276
Soil Sciences								
Agriculture degrees	1,178	1,556	317	411	118	150	1,613	2,117
Agriculture-related degrees	12	13	3	6	--	1	15	20
Total	43,356	51,097	8,283	9,717	1,594	1,872	53,233**	62,686**

*Does not include 1,586 Doctor of Veterinary Medicine degrees granted in 1976-77.

**Does not include 2,000 Doctor of Veterinary Medicine degrees projected to be granted in 1985-86.

Appendix 9. OES survey occupations selected for project

OES survey code	Occupation
71011	Account executives, and/or new business executives
25401	Accountants and auditors
21002	Agricultural engineers
22301	Agricultural scientists
34023	Airplane pilots
32900	All other engineering technicians
21900	All other engineers
43900	All other food service workers
22399	All other life scientists
19000	All other managers
22199	All other mathematical scientists
22299	All other physical scientists
29000	All other professional workers
71900	All other sales agents, sales associates, and/or sales representatives
79000	All other sales workers
33900	All other science technicians
23900	All other social scientists
55014	Animal caretakers
25527	Appraisers (real estate)
25404	Appraisers (except art and real estate appraisers)
25406	Archivists
25517	Assessors
25544	Audiovisual specialists
43001	Bakers (bread and/or pastry)
35003	Biochemistry technologists
25414	Broadcast news analysts
71016	Broker and marker operators (commodities)
25529	Broker's floor representatives, securities traders and/or securities specialists
43004	Butchers and/or meat cutters
25301	Buyers (retail and/or wholesale trade)
25418	Caseworkers
21003	Chemical engineers
22201	Chemists
10057	Chief executives, general administrators and legislators
25526	Claim agents
25533	Claim examiners (property and/or casualty insurance)
25501	Community organization workers
31001	Computer programmers (business)
31002	Computer programmers (scientific and technical)
55A79	Cooks and/or cookers
25427	Cost estimators (engineering)
25550	County agricultural agents (county advisors, county agents, farm agents, and so forth)
25428	Credit analysts, chief
25429	Credit analysts

Appendix 9--Continued

OES survey code	Occupation
61344	Credit authorizers
25454	Curators (museum)
61435	Customer service representatives
72004	Demonstrators
35014	Dietetic technicians
25434	Dietitians and/or nutritionists
10011	Directors (food and beverage), and/or managers (catering)
32003	Drafters
23002	Economists
25443	Employment interviewers
25545	Extension service specialists
51025	Farm equipment mechanics
25440	Film editors
22102	Financial analysts
44060	Fish and game wardens
44059	Forest conservation workers
22308	Foresters and conservation scientists
35006	Histologic technologists
21006	Industrial engineers
55B58	Inspectors
25442	Investigators (insurance)
25403	Landscape architects
25446	Lawyers
25447	Lease buyers
22300	Life scientists
10014	Loan officers
55K84	Log handling equipment operators
55K85	Log inspectors, graders, and/or scalers
55K90	Lumber graders
10021	Managers (sales)
10035	Managers (store)
21008	Mechanical engineers
25450	Media analysts
25414	Media buyers
35004	Microbiology technologists
34019	Museum technicians and/or restorers
25462	Paralegal personnel
25465	Personnel and labor relations specialists
25200	Photographers
33001	Physical science technicians
22200	Physical scientists
22205	Physicists
61355	Procurement clerks
62003	Production clerks and/or coordinators
10001	Public administration inspectors (except construction)
25472	Public-relations practitioners
25300	Purchasing agents and/or buyers
71006	Real estate brokers
44029	Recreation facility attendants
25476	Reporters and correspondents

Appendix 9--Continued

OES survey code	Occupation
25477	Right-of-way agents
21012	Safety engineers
71007	Sales agents (financial service/bank)
71012	Sales agents, sales associates, and/or sales representatives (insurance)
71008	Sales agents, sales associates, and/or sales representatives (real estate)
71009	Sales agents (securities)
71999	Sales representatives, agents and/or associates (nontechnical)
71998	Sales representatives, agents and/or associates (technical)
23005	Sociologists
25530	Special agents (insurance)
32014	Specification writers (engineering)
22104	Statisticians
32008	Surveyors
24001	Systems analysts (business)
24002	Systems analysts (scientific and technical)
25007	Tax examiners, collectors and/or revenue agents
25534	Tax preparers
33005/55Q67	Timber cruisers
23006	Urban and regional planners
55R11	Veneer graders
25488	Veterinarians
25107	Vocational and education counselors (except public school counselors)
10048	Wholesalers
25436	Writers and/or editors

Appendix 10. OES survey industries selected for project

OES survey matrix code	Industry
	Metal Mining (201000 Series)
201010	Iron ores
201020	Copper ores
201030	Lead and zinc ores
201050	Bauxite and other aluminum ores
201090	Miscellaneous metal ores
201100	Anthracite mining
201200	Bituminous coal and lignite mining
201400	Nonmetallic mining and quarrying
201420	Crushed and broken stone
201470	Chemical and fertilizer minerals
201480	Nonmetallic minerals services
201490	Miscellaneous nonmetallic minerals
	Construction (300000 Series)
301500	General building contractors
201620	Heavy construction, nec[1]
301710	Plumbing, heating, and air conditioning
301780	Water well drilling
301790	Miscellaneous special trade contractors
	Manufacturing: Durable Goods (410000 Series)
412410	Logging camps and logging contractors
412420	Sawmills and planing mills
412430	Millwork, plywood, and related products
412440	Wooden containers
412490	Miscellaneous wood products
412510	Household furniture
412520	Office furniture
412530	Public building furniture
413270	Concrete, gypsum, and plaster products
413290	Miscellaneous nonmetallic mineral products
413510	Engines and turbines
413520	Farm machinery and equipment
413530	Construction and related machinery
413550	Special industry machinery and equipment
413560	General industrial machinery and equipment
413570	Office, computing, and accounting machines
413580	Service industry machines
413590	Miscellaneous machinery (except electrical)
413610	Electric transmission and distribution equipment
413630	Household appliances
413640	Electric lighting and wiring equipment
413660	Communication equipment
413670	Electronic components and accessories
413690	Miscellaneous electrical equipment and supplies
413710	Motor vehicles and equipment

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[1] not elsewhere classified.

Appendix 10. OES survey industries selected for project--Continued

OES survey matrix code	Industry
	Manufacturing: Durable Goods (410000 Series)--Continued
413730	Aircraft and parts
413730	Ship and boat building and repairing
413790	Miscellaneous transportation equipment
413800	Professional, scientific instruments
413810	Engineering and scientific instruments
413820	Mechanical measuring and controlling devices
413480	Medical and dental instruments and supplies
	Manufacturing: Nondurable Goods (420000 Series)
422010	Meat products
422020	Dairy products
422030	Canned, cured, and frozen foods
422040	Grain mill products
422050	Bakery products
422060	Sugar
422070	Confectionery and related products
422080	Beverages
422090	Miscellaneous foods and kindred products
422110	Cigarettes
422120	Cigars
422130	Tobacco (chewing and smoking)
422140	Tobacco (stemming and redrying)
422210	Weaving mills (cotton)
422230	Weaving and finishing mills (wool)
422290	Miscellaneous textile goods
422370	Fur goods
422380	Miscellaneous apparel and accessories
422610	Pulp mills
422620	Paper mills (except building paper mills)
422630	Paperboard mills
422640	Converted paper and paperboard products
422650	Paperboard containers and boxes
422660	Building paper and building board mills
422710	Newspaper printing and publishing
422720	Periodical printing and publishing
422730	Books
422740	Miscellaneous publishing
422750	Commercial printing
422810	Industrial chemicals
422830	Drugs
422860	Gum and wood chemicals
422870	Agricultural chemicals
422890	Miscellaneous chemical products
422990	Miscellaneous petroleum and coal products
423060	Fabricated rubber products, nec[1]
423110	Leather tanning and finishing
423120	Industrial leather belting and packing

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[1] nec = not elsewhere classified.

Appendix 10. OES survey industries selected for project--Continued

OES survey matrix code	Industry
	Transportation (510000 Series)
514000	Railroad transportation
514210	Trucking (local and long distance)
514230	Trucking terminal facilities
514410	Deep sea foreign transportation
514420	Deep sea domestic transportation
514430	Great Lakes transportation
514440	Transportation on rivers and canals
514450	Local water transportation
514460	Water transportation services
514510	Certificated air transportation
514520	Noncertificated air transportation
514580	Air transportation services
514720	Arrangement of transportation
514730	Stockyards
514740	Rental of railroad cars
514780	Miscellaneous transportation services
	Communications and Utilities (520000 Series)
524810	Telephone communication
524820	Telegraph communication
524830	Radio and television broadcasting
524890	Communication services, nec[1]
524910	Electric companies and systems
524920	Gas companies and systems
524930	Combination companies and systems
524940	Water supply
524950	Sanitary services
524970	Irrigation systems
	Wholesale Trade (610000 Series)
615010	Motor vehicles and auto parts and supplies
615020	Furniture and home furnishings
615030	Lumber and other construction materials
615040	Sporting, toy, photo, and hobby goods and supplies
615060	Electrical goods
615070	Hardware, plumbing, and heating equipment and supplies
615080	Machinery, equipment, and supplies
615090	Miscellaneous durable goods
615110	Paper and paper products
615120	Drugs, proprietaries, and sundries
615140	Groceries and related products
615150	Farm product raw materials
615160	Chemicals and allied products
615170	Petroleum and petroleum products

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[1] nec = not elsewhere classified.

Appendix 10. OES survey industries selected for project--Continued

OES survey matrix code	Industry
	Wholesale Trade (610000 Series)--Continued
615180	Beer, wine, and distilled alcoholic beverages
615190	Miscellaneous nondurable goods
	Retail Trade (620000 Series)
625210	Lumber and other building materials dealers
625250	Hardware stores
625260	Retail nurseries, lawn and garden supply stores
625390	Miscellaneous general merchandise stores
625410	Food stores
625410	Grocery stores
625420	Meat and fish (seafood) markets, including frozen products
625430	Fruit stores and vegetable markets
625440	Candy, nut, and confectionery stores
625450	Dairy products stores
625490	Miscellaneous food stores
625530	Auto and home supply stores
625550	Boat dealers
625560	Recreational and utility trailer dealers
625800	Eating and drinking places
625960	Nonstore retailers
625350	Direct selling
	Finance, Insurance, and Real Estate (700000 Series)
706010	Federal reserve banks
706020	Commercial and stock savings banks
706030	Mutual savings banks
706040	Trust companies (nondeposit)
706050	Functions closely related to banking
706110	Rediscount and financing institutions
706120	Savings and loan associations
706130	Agricultural credit institutions
706150	Business credit institutions
706160	Loan correspondents and brokers
706210	Security brokers and dealers
706220	Commodity contracts brokers and dealers
706230	Security and commodity exchanges
706280	Security and commodity services
706310	Life insurance
706320	Accident and health insurance
706330	Fire, marine, and casualty insurance
706350	Surety insurance
706360	Title insurance
706510	Real estate operators and lessors
706530	Agents, brokers, and managers
706540	Title abstract companies
706550	Subdividers and developers
706710	Holding companies

Appendix 10. OES survey industries selected for project--Continued

OES survey matrix code	Industry
	Finance, Insurance, and Real Estate (700000 Series)--Continued
706720	Investment companies
706730	Trusts
706790	Miscellaneous investing institutions
	Services (800000 Series)
807010	Hotels, tourist courts, and motels
80730	Trailer parks and camps
807040	Membership-basis organization hotels
807310	Advertising
807320	Credit reporting and collection
807340	Services to buildings
807350	News syndicates
807360	Private employment agencies
807390	Miscellaneous business services
807690	Miscellaneous repair shops
807810	Motion picture production and distribution
807940	Miscellaneous amusement and recreation services
808060	Hospitals
808070	Medical and dental laboratories
808090	Health and allied services, nec[1]
808410	Museums and art galleries
808420	Arboreta, botanical, and zoological gardens
808610	Business associations
808620	Professional organizations
808630	Labor unions and similar organizations
808640	Civic, social, and fraternal associations
808650	Political organizations
808660	Religious organizations
808670	Charitable organizations
808690	Nonprofit membership organizations, nec[1]
808910	Engineering and architectural services
808920	Nonprofit research agencies
808930	Accounting, auditing, and bookkeeping services
808990	Services, nec[1]

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1. nec = not elsewhere classified.

Appendix 11. Example of Industry-Occupation matrix

OES survey occupation	OES survey industry														
	Hospitals	Commodity contracts brokers and dealers	Agricultural credit institutions	Commercial and stock savings bank	Retail nurseries, lawn and garden supplies	Farm product and raw materials	Groceries and related products	Irrigation systems	Stockyards	Trucking, local and long distance	Railroad transportation	Agricultural chemicals	Dairy products	Meat products	Farm machinery and equipment
Agricultural Engineer															
Agricultural Scientist															
Animal Caretaker															
Baker, Bread and/or Pastry															
Broker and Market Operator															
Butcher and/or Meat Cutter															
Chemist															
County Agricultural Agent															
Customer Service Representative															
Dietitian and/or Nutritionist															
Economist															
Extension Service Specialist															
Farm Equipment Mechanic															
Fish and Game Warden															
Forest Conservation Worker															
Forester and Conservation Scientist															
Landscape Architect															
Life Scientist															
Lumber Grader															
Surveyor															
Timber Cruiser															
Veterinarian															

Appendix 12. Overview of matrix conversion process

1. Development of original OES survey-based Industry-Occupation matrix

	OES survey industry				
OES survey occupation	#1	#2	#3	#4	#5
#1	10%	2%	4%	15%	9%
#2	5%	6%	0%	10%	6%
#3	3%	5%	3%	8%	0%
#4	7%	3%	1%	6%	4%

Percentages represent proportion of total workers in a given occupation for a given industry.

2. Transformation from OES survey occupations and industries to OES Census occupations and industries

Occupations

OES survey occupation 1
OES survey occupation 2
OES survey occupation 3
> OES Census occupation 1

Industries

OES survey industry 1
OES survey industry 2
OES survey industry 3
OES survey industry 4
> OES Census occupation 1

3. Development of OES Census-based Industry-Occupation matrix

	Census industry 1
Census occupation 1	5%*

*Percentage represents proportion of total workers in a given occupation for a given industry; based on weighted averages.

Appendix 13. OES Census-based occupations used in project with corresponding 1970 Census population codes and OES Census matrix codes

Occupation	1970 Census code	OES Census matrix code
Accountants	001	10240050
Adult educators	141	10200050
Advertising agents and sales workers	260	30000050
Agricultural extension workers	N/A[1]	N/A[1]
Agricultural scientists	042	10040050
Agricultural and biological technicals (except health)	150	10080050
Animal caretakers (except farm)	740	80000050
Architects	002	10240100
Archivists and curators	033	10240150
Assessors, controllers, treasurers--local public administration	201	20040050
Atmospheric and space scientists	043	10040100
Authors	181	10220150
Bakers	402	50140050
Bank officers and financial managers	202	20020050
Biological scientists	044	20020050
Blue-collar worker supervisor, nec[2]	441	50040000
Buyers and shippers (farm products)	203	10040150
Buyers (wholesale and retail trade)	205	20020150
Checkers, examiners, inspectors (manufacturing)	610	20020200
Chemical technicians	151	61060050
Chemists	045	10080100
Clinical laboratory technologists and technicians	080	10040200
College and university faculty	N/A[3]	N/A[3]
Credit and collection managers	210	10020100
Demonstrators	262	20020100
Dietitians	074	30000150
Drafters	152	10100150
Economists	091	10080150
Editors and reporters	184	10180050
Electrical and electronic engineers	012	10220300
Engineers, nec (agricultural engineers)	023	10020200
Expeditors and product controllers	323	10020550
Estimators and investigators, nec	321	40060550
Farm labor supervisors	821	90040050
Farm implement mechanics	480	50080400
Farm management advisors (except extension personnel)	024	10240300
Farm managers	802	90020100
Farm service laborers, self-employed	824	90040200
Farmers (owners and tenants)	801	90020050
Food service workers, nec (except private)	916	70040350
Foresters and conservationists	025	10240350
Gardeners and groundkeepers (except farm)	755	80000350
Geologists	051	10040250
Graders and sorters (manufacturing)	624	61060100

See footnotes at end of appendix.

Appendix 13. OES Census-based occupations used in project with corresponding 1970 Census population codes and OES Census matrix codes--Continued

Occupation	1970 Census Code	OES Census matrix code
Health aides (except nursing)	922	70060100
Health technicians/technologists, nec	085	10120300
Industrial engineers	013	10020250
Inspectors, public administration (except construction)	215	20040200
Inspectors, nec	452	50140550
Inspectors, scalers and graders (log and lumber)	450	50140500
Insurance agents, brokers and underwriters	265	30000250
Insurance adjusters, examiners and investigators	326	40060700
Librarians	032	10240550
Life and physical scientists, nec	054	10040400
Managers and administrators, nec	245	10040400
Marine scientists	052	20060400
Meat cutters and butchers (except manufacturing)	631	10040300
Mechanical engineers	014	61080750
Officials and administrators, nec (public administrators)	222	10020300
Photographers	919	20040250
Personnel and labor relations workers	056	10220450
Produce graders and packers (except factory and farm)	625	10240650
Public relations specialists and publicity writers	192	61060250
Purchasing agents and buyers, nec	225	10220500
Radio and television announcers	193	10220550
Real estate agents and brokers	270	30000350
Real estate appraisers	363	40061150
Recreation workers	101	10240750
Restaurant, cafe and bar managers	230	20060350
Sales managers and department heads (retail)	231	20020300
Sales managers (except retail)	233	20020350
Sales workers and sales clerks, nec	281-285	30000450
Secondary vocational agriculture teachers	N/A[4]	N/A[4]
Social workers	100	10240800
Sociologists	094	10180200
Statisticians	036	10060150
Stock and bond sales agents	271	30000400
Surveyors	161	10080400
Urban and regional planners	095	10180250
Veterinarians	072	10100500
Writers, artists and entertainers, nec	194	10220600

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1. Used USDA data rather than OES Census-based data.
2. nec = not elsewhere classified
3. Used data provided by USDA-SEA funded study by Clemson University.
4. Used data provided by American Vocational Association.

Appendix 14. OES Census-based industries used in project with corresponding OES Census matrix codes

OES Census matrix code	Industry
100110	Agricultural production
100130	Agricultural services (except horticulture)
100170	Horticultural services
100800	Forestry
100900	Fisheries
201000	Metal mining
201100	Coal mining
201400	Nonmetallic mining and quarry
301500	General building contractors
301600	General contractors (except building)
301700	Special trade contractors
412410	Logging
412420	Sawmill planing mill, millwork
412440	Miscellaneous wood products
412500	Furniture and fixtures
413240	Cement, concrete, plaster
413280	Miscellaneous, nonmetallic stone
413510	Engines and turbines
413520	Farm machinery, equipment
413530	Construction machines
413560	Office, accounting machines
413590	Machinery, nec[1]
413690	Electrical machinery, nec
413630	Household appliances
413650	Radio, television, communications equipment
413710	Motor vehicle equipment
413720	Aircraft and parts
413730	Ship, boat building, repair
413790	Cycles, miscellaneous transportation equipment
413810	Scientific instruments
413830	Optical, health service supplies
422010	Meat products
422020	Dairy products
422030	Canning and preserving
422040	Grain mill products
422050	Bakery products
422070	Confectionery products
422080	Beverage industries
422090	Miscellaneous food preparation
422100	Tobacco manufacturing
422280	Yarn, fabric mills
422290	Miscellaneous textile mill products
422310	Apparel and accessories
422610	Pulp, paper, paperboard mills
422650	Paperboard containers, boxes
422660	Miscellaneous paper and pulp products
422710	Newspaper publishing printing
422720	Print, publishing (except newspaper)
422810	Industrial chemicals

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1. nec = not elsewhere classified.

Appendix 14. OES Census-based industries used in project with corresponding OES Census matrix codes--Continued

OES Census matrix code	Industry
422840	Drugs and medicines
422870	Agriculture chemicals
422890	Miscellaneous chemicals
422980	Miscellaneous petrol, coal products
423010	Rubber products
423110	Leather tanning, finishing
423180	All other leather products
514000	Railroads, railway express
514210	Trucking services
514440	Water transportation
514500	Air transportation
514700	Transportation services
524810	Telephone (wire and radio)
524820	Telegraph, miscellaneous communication services
524830	Radio broadcasting, television
524910	Electric light and power
524920	Electric, gas, utilities
524930	Gas, steam, supply systems
524940	Water supply
524980	Sanitary services
524970	Other utilities
615010	Motor vehicles and equipment
615020	Drugs, chemicals, allied products
615040	Food and related products
615050	Farm products (raw materials)
615060	Electrical goods
615070	Hardware, plumbing
615080	Machinery, equipment, supplies
625210	Lumber, building materials
615950	Alcoholic beverages
615920	Petroleum products
615960	Paper and paper products
615990	Wholesale, nec[1]
625250	Hardware and farm equipment
625380	Miscellaneous merchandise stores
625410	Grocery stores
625450	Dairy stores
625490	Food stores, nec[1]
625530	Tire, battery, accessory
625590	Miscellaneous vehicle dealers
625310	Department store, mail order
625340	Vending machine operators
625350	Direct selling
625800	Eating and drinking places
706010	Banking
706020	Credit agencies
706070	Stock brokers, investment
706300	Insurance
706500	Real estate, real estate law, insurance

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1. nec = not elsewhere classified.

Appendix 14. OES Census-based industries used in project with corresponding OES Census matrix codes--Continued

OES Census matrix code	Industry
807010	Hotels and motels
807040	Lodging place (except hotels)
807310	Advertising
807360	Employment, temporary help
807370	Services (building)
807390	Other miscellaneous business services
807630	Other repair services
807800	Motion pictures, theaters
807940	Miscellaneous entertainment
808060	Hospitals
808090	Health services, nec[1]
808300	Museums, art galleries, zoos
808660	Religious organizations
808670	Welfare services
808690	Nonprofit membership organizations
808910	Engineering and architectural services
808980	Accounting, auditing
808990	Miscellaneous professional services
909120	Postal services
909190	Federal public administration
909300	Local public administration

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[1] nec = not elsewhere classified.

Appendix 15-1--Associate degrees: Estimated percentage distributions of graduates of educational clusters to occupational clusters

Occupational cluster	Educational cluster										
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences
Scientific and Professional Specialists	--	--	--	--	--	--	--	--	--	--	--
Manufacturing and Processing Scientists and Engineers	--	--	--	--	--	--	30	--	--	--	--
Sales and Service Representatives and Purchasing Agents	--	45	20	--	--	25	30	--	5	30	--
Administrators, Managers, and Financial Advisors	--	--	--	--	--	--	--	--	--	--	--
Educators	--	--	--	--	--	--	--	--	--	--	--
Media Specialists	--	--	--	--	--	--	--	--	--	--	--
Agricultural Production and Management Specialists	--	30	20	--	--	40	--	--	3	35	--
Miscellaneous Agricultural Specialists	--	20	55	--	--	3-	35	--	25	30	--
Other	--	5	5	--	--	5	5	--	67	5	--
Continue education											
Do not enter labor force											
Enter job unrelated to academic degree											
Return to native country											
Miscellaneous reasons											
Total	--	100	100	--	--	100	100	--	100	100	--

Appendix 15-2--Baccalaureate degrees: Estimated percentage distributions of graduates of educational clusters to occupational clusters

Occupational cluster	Educational cluster										
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences
Scientific and Professional Specialists	—	5	30	75	10	8	50	—	35	8	20
Manufacturing and Processing Scientists and Engineers	—	—	30	10	—	—	10	—	21	—	—
Sales and Service Representatives and Purchasing Agents	40	30	20	15	10	35	15	80	10	40	25
Administrators, Managers, and Financial Advisors	—	20	—	—	2	5	—	—	1	5	5
Educators	10	5	5	—	40	8	5	—	1	8	10
Media Specialists	—	—	—	—	15	—	—	—	—	—	—
Agricultural Production and Management Specialists	40	15	5	—	3	20	—	—	2	15	15
Miscellaneous Agricultural Specialists	—	5	—	—	—	4	5	—	5	4	—
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	10	20	10	—	20	20	15	20	25	20	25
Total	100	100	100	100	100	100	100	100	100	100	100

Appendix 15-3--Master's degrees: Estimated percentage distributions of graduates of educational clusters to occupational clusters

Occupational cluster	Educational cluster										
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences
Scientific and Professional Specialists	--	20	15	60	--	15	30	--	20	15	20
Manufacturing and Processing Scientists and Engineers	--	--	25	35	--	--	30	--	15	--	--
Sales and Service Representatives and Purchasing Agents	67	10	--	5	10	20	5	--	5	20	10
Administrators, Managers, and Financial Advisors	--	35	--	--	15	--	--	--	10	--	10
Educators	--	10	10	--	35	20	15	--	5	20	10
Media Specialists	--	--	--	--	25	--	--	--	--	--	--
Agricultural Production and Management Specialists	33	10	--	--	5	5	--	--	--	5	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	--	15	50	--	10	40	20	--	45	40	50
Total	100	100	100	100	100	100	100	--	100	100	100

Appendix 15-4--Doctoral degrees: Estimated percentage distributions of graduates of educational clusters to occupational clusters

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences
						Ph.D.	D.V.M.					
Scientific and Professional Specialists	--	30	10	60	15	40	72	20	--	45	30	40
Manufacturing and Processing Scientists and Engineers	--	--	45	20	--	--	10	30	--	20	--	--
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	8	--	--	--	--	--
Administrators, Managers, and Financial Advisors	--	30	--	--	--	--	--	--	--	--	--	--
Educators	--	20	5	20	50	45	10	30	--	20	45	35
Media Specialists	--	--	--	--	15	--	--	--	--	--	--	--
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	20	40	--	20	15	--	20	--	15	25	25
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	100	100	100	100	100	100	100	--	100	100	100

Appendix 16-1--Associate degrees: 1976-77 Graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Manufacturing and Processing Scientists and Engineers	--	--	--	--	--	--	44	--	--	--	--	44
Sales and Service Representatives and Purchasing Agents	--	23	118	--	--	234	44	--	74	442	--	935
Administrators, Managers, and Financial Advisors	--	--	--	--	--	--	--	--	--	--	--	--
Educators	--	--	--	--	--	--	--	--	--	--	--	--
Media Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Production and Management Specialists	--	16	118	--	--	374	--	--	44	516	--	1,068
Miscellaneous Agricultural Specialists	--	11	325	--	--	280	51	--	369	442	--	1,478
Other												
Continue education	--	3	29	--	--	47	7	--	990	74	--	1,150
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	53	590	--	--	935	146	--	1,477	1,474	--	4,675

Appendix 16-2--Baccalaureate degrees: 1976-77 Graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	180	151	--	170	399	2,732	--	3,457	327	236	7,652
Manufacturing and Processing Scientists and Engineers	--	--	151	--	--	--	546	--	2,074	--	--	2,771
Sales and Service Representatives and Purchasing Agents	37	1,082	102	--	170	1,747	820	--	987	1,637	294	6,876
Administrators, Managers, and Financial Advisors	--	721	--	--	34	250	--	--	99	205	59	1,368
Educators	9	180	25	--	678	399	273	--	99	327	118	2,108
Media Specialists	--	--	--	--	255	--	--	--	--	--	--	255
Agricultural Production and Management Specialists	37	541	25	--	51	998	--	--	198	614	177	2,641
Miscellaneous Agricultural Specialists	--	180	--	--	--	200	273	--	494	164	--	1,311
Other	9	721	50	--	339	998	819	--	2,469	819	294	6,518
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	92	3,605	504	--	1,697	4,991	5,463	--	9,877	4,093	1,178	31,500

Appendix 16-3--Master's degrees: 1976-77 Graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	134	20	--	--	91	415	--	278	132	63	1,133
Manufacturing and Processing Scientists and Engineers	--	--	33	--	--	--	414	--	208	--	--	655
Sales and Service Representatives and Purchasing Agents	4	67	--	--	85	121	69	--	69	176	32	623
Administrators, Managers, and Financial Advisors	--	235	--	--	127	--	--	--	139	--	32	533
Educators	--	67	13	--	297	122	207	--	69	176	32	983
Media Specialists	--	--	--	--	212	--	--	--	--	--	--	212
Agricultural Production and Management Specialists	2	67	--	--	42	30	--	--	--	44	--	185
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	102	67	--	85	242	276	--	625	352	158	1,907
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	6	672	133	--	848	606	1,381	--	1,388	880	317	6,231

Appendix 16-4--Doctoral degrees: 1976-77 Graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						PhD.	D.VM.						
Scientific and Professional Specialists	--	44	3	--	5	61	1,142	47	--	87	90	47	1,526
Manufacturing and Processing Scientists and Engineers	--	--	10	--	--	--	167	72	--	38	--	--	287
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	125	--	--	--	--	--	125
Administrators, Managers, and Financial Advisors	--	44	--	--	--	--	--	--	--	--	--	--	44
Educators	--	29	1	--	16	68	152	71	--	38	136	41	552
Media Specialists	--	--	--	--	5	--	--	--	--	--	--	--	5
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	29	9	--	7	23	--	47	--	29	75	30	249
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	--	146	23	--	33	152	1,586	237	--	192	301	118	2,788

Appendix 16-5--Total Agriculture degrees: 1976-77 Graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

	Educational cluster												
Occupational cluster	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						(1/)	DVM						
Scientific and Professional Specialists	—	358	174	--	175	551	1,142	3,194	—	3,822	549	346	10,311
Manufacturing and Processing Scientists and Engineers	--	—	194	—	--	—	167	1,076	—	2,320	—	—	3,757
Sales and Service Representatives and Purchasing Agents	41	1,172	220	—	255	2,102	125	933	--	1,130	2,255	326	8,559
Administrators, Managers, and Financial Advisors	—	1,000	—	--	161	250	--	--	--	238	205	91	1,945
Educators	9	276	39	--	991	589	152	551	--	206	639	191	3,643
Media Specialists	--	--	—	--	472	—	--	--	--	—	—	--	472
Agricultural Production and Management Specialists	39	624	143	--	93	1,402	--	—	--	242	1,174	177	3,894
Miscellaneous Agricultural Specialists	—	191	325	—	--	480	—	324	—	863	606	--	2,789
Other	9	855	155	—	431	1,310	--	1,149	--	4,113	1,320	482	9,824
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	98	4,476	1,250	--	2,578	6,684	1,586	7,227	--	12,934	6,748	1,613	45,194

1. Includes associate, baccalaureate, master's, and doctoral degrees.

Appendix 17-1--Associate degrees: 1976-77 Graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Manufacturing and Processing Scientists and Engineers	--	--	--	--	--	--	--	--	--	--	--	--
Sales and Service Representatives and Purchasing Agents	--	410	10	--	--	19	1	--	3	--	--	443
Administrators, Managers, and Financial Advisors	--	--	--	--	--	--	--	--	--	--	--	--
Educators	--	--	--	--	--	--	--	--	--	--	--	--
Media Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Production and Management Specialists	--	273	10	--	--	30	--	--	2	1	--	316
Miscellaneous Agricultural Specialists	--	182	28	--	--	21	--	--	17	--	--	248
Other	--	46	3	--	--	4	--	--	46	--	--	99
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	911	51	--	--	74	1	--	68	1	--	1,106

Appendix 17-2--Baccalaureate degrees: 1976-77 Graduates with Agriculcure-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	362	57	1,152	103	103	52	--	100	12	2	1,943
Manufacturing and Processing Scientists and Engineers	--	--	57	154	--	--	11	--	60	--	--	282
Sales and Service Representatives and Purchasing Agents	--	2,173	38	231	103	453	16	10	29	57	3	3,113
Administrators, Managers, and Financial Advisors	--	1,449	--	--	21	65	--	--	3	7	1	1,546
Educators	--	362	9	--	413	103	5	--	3	11	1	907
Media Specialists	--	--	--	--	155	--	--	--	--	--	--	155
Agricultural Production and Management Specialists	--	1,087	10	--	31	259	--	--	6	22	2	1,417
Miscellaneous Agricultural Specialists	--	362	--	--	--	52	5	--	14	6	--	439
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	--	1,449	19	--	206	258	16	2	72	29	3	2,054
Total	--	7,244	190	1,537	1,032	1,293	105	12	287	144	12	11,856

Appendix 17-3--Master's degrees: 1976-77 Graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	217	16	64	--	39	6	--	12	9	1	364
Manufacturing and Processing Scientists and Engineers	--	--	26	37	--	--	6	--	9	--	--	78
Sales and Service Representatives and Purchasing Agents	--	109	--	5	36	52	1	--	3	12	1	219
Administrators, Managers, and Financial Advisors	--	380	--	--	53	--	--	--	6	--	--	439
Educators	--	109	10	--	125	51	3	--	3	12	--	313
Media Specialists	--	--	--	--	89	--	--	--	--	--	[illegible]	89
Agricultural Production and Management Specialists	--	109	--	--	18	13	--	--	--	3	--	143
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	163	52	--	35	102	4	--	25	25	1	407
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	1,087	104	106	356	257	20	--	58	61	3	2,052

Appendix 17-4--Doctoral degrees: 1976-77 Graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	10	--	67	2	72	1	--	7	11	--	170
Manufacturing and Processing Scientists and Engineers	--	--	--	22	--	--	--	--	3	--	--	25
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	--	--	--	--	--	--
Administrators, Managers, and Financial Advisors	--	10	--	--	--	--	--	--	--	--	--	10
Educators	--	7	--	22	7	82	--	--	3	16	--	137
Media Specialists	--	--	--	--	2	--	--	--	--	--	--	2
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	--	7	--	--	3	27	--	--	2	9	--	48
Total	--	34	--	111	14	181	1	--	15	36	--	392

Appendix 17-5--Total Agriculture-related degrees: 1976-77 Graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	589	73	1,283	105	214	59	--	119	32	3	2,477
Manufacturing and Processing Scientists and Engineers	--	--	83	213	--	--	17	--	72	--	--	385
Sales and Service Representatives and Purchasing Agents	--	2,692	48	236	139	524	18	10	35	69	4	3,775
Administrators, Managers, and Financial Advisors	--	1,839	--	--	74	65	--	--	9	7	1	1,995
Educators	--	478	19	22	545	236	8	--	9	39	1	1,357
Media Specialists	--	--	--	--	246	--	--	--	--	--	--	246
Agricultural Production and Management Specialists	--	1,469	20	--	49	301	--	--	8	26	2	1,875
Miscellaneous Agricultural Specialists	--	544	28	--	--	73	5	--	31	6	--	687
Other	--	1,665	74	--	244	391	20	2	145	63	4	2,608
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	9,276	345	1,754	1,402	1,804	127	12	428	242	15	15,405

Appendix 18-1—Associate degrees: Summary of 1976-77 graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Manufacturing and Processing Scientists and Engineers	--	--	--	--	--	--	44	--	--	--	--	44
Sales and Service Representatives and Purchasing Agents	--	433	128	--	--	253	45	--	77	442	--	1,378
Administrators, Managers, and Financial Advisors	--	--	--	--	--	--	--	--	--	--	--	--
Educators	--	--	--	--	--	--	--	--	--	--	--	--
Media Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Agricultural Production and Management Specialists	--	289	128	--	--	404	--	--	46	517	--	1,384
Miscellaneous Agricultural Specialists	--	193	353	--	--	301	51	--	386	442	--	1,726
Other	--	49	32	--	--	51	7	--	1,036	74	--	1,249
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	964	641	--	--	1,009	147	--	1,545	1,475	--	5,781

Appendix 18-2--Baccalaureate degrees: Summary of 1976-77 graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	542	208	1,153	273	503	2,785	--	3,557	339	238	9,598
Manufacturing and Processing Scientists and Engineers	--	--	208	154	--	--	557	--	2,134	--	--	3,053
Sales and Service Representatives and Purchasing Agents	37	3,256	139	230	273	2,199	835	10	1,016	1,695	298	9,988
Administrators, Managers, and Financial Advisors	--	2,170	--	--	55	315	--	--	102	212	60	2,914
Educators	9	542	35	--	1,091	503	278	--	102	339	119	3,018
Media Specialists	--	--	--	--	409	--	--	--	--	--	--	409
Agricultural Production and Management Specialists	37	1,627	35	--	82	1,256	--	--	204	636	178	4,055
Miscellaneous Agricultural Specialists	--	542	--	--	--	252	278	--	508	169	--	1,749
Other	9	2,170	69	--	546	1,255	835	2	2,541	847	297	8,571
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	92	10,849	694	1,537	2,729	6,283	5,568	12	10,164	4,237	1,190	43,355

Appendix 18-3--Master's degrees: Summary of 1976-77 graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	351	36	64	--	130	421	--	290	141	64	1,497
Manufacturing and Processing Scientists and Engineers	--	--	59	37	--	--	420	--	217	--	--	733
Sales and Service Representatives and Purchasing Agents	4	176	--	5	121	173	70	--	72	188	33	842
Administrators, Managers, and Financial Advisors	--	615	--	--	180	--	--	--	145	--	32	972
Educators	--	176	23	--	422	173	210	--	72	188	32	1,296
Media Specialists	--	--	--	--	301	--	--	--	--	--	--	301
Agricultural Production and Management Specialists	2	176	--	--	60	43	--	--	--	47	--	328
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	265	119	--	120	344	280	--	650	377	159	2,314
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	6	1,759	237	106	1,204	863	1,401	--	1,446	941	320	8,283

Appendix 18-4--Doctoral degrees: Summary of 1976-77 graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						Ph.D.	D.V.M.						
Scientific and Professional Specialists	--	54	3	67	7	133	1,142	48	--	94	101	47	1,696
Manufacturing and Processing Scientists and Engineers	--	--	10	22	--	--	167	72	--	41	--	--	312
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	125	--	--	--	--	--	125
Administrators, Managers, and Financial Advisors	--	54	--	--	--	--	--	--	--	--	--	--	54
Educators	--	36	1	22	23	150	152	71	--	41	152	41	689
Media Specialists	--	--	--	--	7	--	--	--	--	--	--	--	7
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	36	9	--	10	50	--	47	--	31	84	30	297
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	--	180	23	111	47	333	1,586	238	--	207	337	118	3,180

Appendix 18-5--Total Agriculture/Agriculture-related degrees: Summary of 1976-77 graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences (1/)	Animal Sciences D.V.M.	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	—	947	247	1,283	280	765	1,142	3,253	--	3,941	581	349	12,788
Manufacturing and Processing Scientists and Engineers	--	--	277	213	--	—	167	1,093	—	2,392	--	--	4,142
Sales and Service Representatives and Purchasing Agents	41	3,864	268	236	394	2,626	125	951	10	1,165	2,324	330	12,334
Administrators, Managers, and Financial Advisors	—	2,839	--	--	235	315	--	--	--	247	212	92	3,940
Educators	9	754	58	22	1,536	825	152	559	--	215	678	192	5,000
Media Specialists	--	--	--	--	718	--	--	--	--	--	--	--	718
Agricultural Production and Management Specialists	39	2,093	163	--	142	1,704	--	--	--	250	1,200	179	5,770
Miscellaneous Agricultural Specialists	--	735	353	--	--	553	--	329	--	894	612	--	3,476
Other	9	2,520	229	--	675	1,701	--	1,169	2	4,258	1,383	486	12,432
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	98	13,752	1,595	1,754	3,980	8,489	1,586	7,354	12	13,362	6,990	1,628	60,600

1. Includes associate, baccalaureate, master's, and doctoral degrees.

Appendix 19-1--Baccalaureate degrees: 1985-86 Projected graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

	Educational cluster											
Occupational cluster	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	216	240	--	170	500	2,541	--	4,306	453	311	8,737
Manufacturing and Processing Scientists and Engineers	--	--	240	--	--	--	508	--	2,584	--	--	3,332
Sales and Service Representatives and Purchasing Agents	43	1,296	160	--	170	2,188	762	--	1,230	2,268	389	8,506
Administrators, Managers, and Financial Advisors	--	864	--	--	34	313	--	--	123	284	78	1,696
Educators	10	216	40	--	680	500	254	--	123	453	156	2,432
Media Specialists	--	--	--	--	255	--	--	--	--	--	--	255
Agricultural Production and Management Specialists	43	648	40	--	51	1,250	--	--	246	851	233	3,362
Miscellaneous Agricultural Specialists	--	216	--	--	--	250	254	--	615	227	--	1,562
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	11	864	80	--	340	1,250	763	--	3,076	1,135	389	7,908
Total	107	4,320	800	--	1,700	6,251	5,082	--	12,303	5,671	1,556	37,790

Appendix 19-2--Master's degrees: 1985-86 Projected graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	172	28	--	--	128	477	--	337	166	82	1,390
Manufacturing and Processing Scientists and Engineers	--	--	47	--	--	--	477	--	253	--	--	777
Sales and Service Representatives and Purchasing Agents	6	86	--	--	57	171	79	--	84	222	41	746
Administrators, Managers, and Financial Advisors	--	300	--	--	86	--	--	--	168	--	41	595
Educators	--	86	19	--	200	171	238	--	84	222	41	1,061
Media Specialists	--	--	--	--	143	--	--	--	--	--	--	143
Agricultural Production and Management Specialists	3	86	--	--	29	43	--	--	--	55	--	216
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	--	129	92	--	55	341	318	--	758	444	206	2,343
Total	9	859	186	--	570	854	1,589	--	1,684	1,109	411	7,271

Appendix 19-3--Doctoral degrees: 1985-86 Projected graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						Ph.D.	D.V.M.						
Scientific and Professional Specialists	--	56	7	--	3	70	1,440	51	--	110	104	60	1,901
Manufacturing and Processing Scientists and Engineers	--	--	31	--	--	--	200	77	--	49	--	--	357
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	160	--	--	--	--	--	160
Administrators, Managers, and Financial Advisors	--	56	--	--	--	--	--	--	--	--	--	--	56
Educators	--	37	3	--	11	79	200	77	--	49	156	53	665
Media Specialists	--	--	--	--	3	--	--	--	--	--	--	--	3
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Other Continue education Do not enter labor force Enter job unrelated to academic degree Return to native country Miscellaneous reasons	--	37	27	--	4	27	--	51	--	36	86	37	305
Total	--	186	68	--	21	176	2,000	256	--	244	346	150	3,447

Appendix 19-4--Total 'griculture degrees: 1985-86 Projected graduates with Agriculture degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						(1/)	DVM						
Scientific and Professional Specialists	--	444	275	--	173	698	1,440	3,069	--	4,753	723	453	12,028
Manufacturing and Processing Scientists and Engineers	--	--	318	--	--	--	200	1,062	--	2,886	--	--	4,466
Sales and Service Representatives and Purchasing Agents	49	1,382	160	--	227	2,359	160	841	--	1,314	2,490	430	9,412
Administrators, Managers, and Financial Advisors	--	1,220	--	--	120	313	--	--	--	291	284	119	2,347
Educators	10	339	62	--	891	750	200	569	--	256	831	250	4,158
Media Specialists	--	--	--	--	401	--	--	--	--	--	--	--	401
Agricultural Production and Management Specialists	46	734	40	--	80	1,293	--	--	--	246	906	233	3,578
Miscellaneous Agricultural Specialists	--	216	--	--	--	250	--	254	--	615	227	--	1,562
Other	11	1,029	199	--	399	618	--	1,132	--	3,870	1,665	632	10,555
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	116	5,364	1,054	--	2,291	7,281	2,000	6,927	--	14,231	7,126	2,117	48,507

1. Includes baccalaureate, master's, and doctoral degrees.

Appendix 20-1--Baccalaureate degrees: 1985-86 Projected graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	416	132	1,185	115	94	52	--	113	14	2	2,123
Manufacturing and Processing Scientists and Engineers	--	--	132	158	--	--	11	--	68	--	--	369
Sales and Service Representatives and Purchasing Agents	--	2,496	88	237	115	413	16	15	32	72	3	3,487
Administrators, Managers, and Financial Advisors	--	1,664	--	--	23	59	--	--	3	9	1	1,759
Educators	--	416	22	--	459	94	5	--	3	14	1	1,014
Media Specialists	--	--	--	--	172	--	--	--	--	--	--	172
Agricultural Production and Management Specialists	--	1,248	22	--	34	236	--	--	6	27	2	1,575
Miscellaneous Agricultural Specialists	--	416	--	--	--	47	5	--	16	7	--	491
Other	--	1,665	43	--	229	236	16	4	82	38	4	2,317
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	8,321	439	1,580	1,147	1,179	105	19	323	181	13	13,307

Appendix 20-2--Master's degrees: 1985-86 Projected graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	263	25	72	--	50	6	--	14	9	1	440
Manufacturing and Processing Scientists and Engineers	--	--	42	42	--	--	6	--	11	--	--	101
Sales and Service Representatives and Purchasing Agents	--	131	--	6	36	66	1	--	4	12	1	257
Administrators, Managers, and Financial Advisors	--	460	--	--	53	--	--	--	7	--	--	520
Educators	--	131	17	--	125	66	3	--	4	12	1	359
Media Specialists	--	--	--	--	89	--	--	--	--	--	--	89
Agricultural Production and Management Specialists	--	131	--	--	18	16	--	--	--	3	--	168
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	198	85	--	35	130	5	--	32	25	3	513
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	1,314	169	120	356	328	21	--	72	61	6	2,447

Appendix 20-3--Doctoral degrees: 1985-86 Projected graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	19	1	64	3	71	1	--	8	10	1	178
Manufacturing and Processing Scientists and Engineers	--	--	2	21	--	--	--	--	4	--	--	27
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	--	--	--	--	--	--
Administrators, Managers, and Financial Advisors	--	19	--	--	--	--	--	--	--	--	--	19
Educators	--	13	--	21	--	80	--	10	4	15	--	143
Media Specialists	--	--	--	--	3	--	--	--	--	--	--	3
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	12	2	--	4	26	--	--	2	9	--	55
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	63	5	106	10	177	1	10	18	34	1	425

Appendix 20-4--Total Agriculture-related degrees: 1985-86 Projected graduates with Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	698	158	1,321	118	215	59	--	135	33	4	2,741
Manufacturing and Processing Scientists and Engineers	--	--	176	221	--	--	17	--	83	--	--	497
Sales and Service Representatives and Purchasing Agents	--	2,627	88	243	151	479	17	15	36	84	4	3,744
Administrators, Managers, and Financial Advisors	--	2,143	--	--	76	59	--	--	10	9	1	2,298
Educators	--	560	39	21	598	240	8	--	8	41	1	1,516
Media Specialists	--	--	--	--	264	--	--	--	--	--	--	264
Agricultural Production and Management Specialists	--	1,379	22	--	52	252	--	--	6	30	2	1,743
Miscellaneous Agricultural Specialists	--	416	--	--	--	47	5	--	16	7	--	491
Other	--	1,875	130	--	268	392	21	4	116	72	7	2,885
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	--	9,698	613	1,806	1,527	1,684	127	19	410	276	19	16,179

Appendix 21-1--Baccalaureate degrees: Summary of 1985-86 projected graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

	Educational cluster											
Occupational cluster	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	632	372	1,185	285	594	2,593	--	4,419	467	313	10,860
Manufacturing and Processing Scientists and Engineers	--	--	372	158	--	--	519	--	2,652	--	--	3,701
Sales and Service Representatives and Purchasing Agents	43	3,792	248	237	285	2,601	778	15	1,262	2,340	392	11,993
Administrators, Managers, and Financial Advisors	--	2,528	--	--	57	372	--	--	126	293	79	3,455
Educators	10	632	62	--	1,139	594	259	--	126	467	157	3,446
Media Specialists	--	--	--	--	427	--	--	--	--	--	--	427
Agricultural Production and Management Specialists	43	1,896	62	--	85	1,486	--	--	252	878	235	4,937
Miscellaneous Agricultural Specialists	--	632	--	--	--	297	259	--	631	234	--	2,053
Other	11	2,529	123	--	569	1,486	779	4	3,158	1,173	393	10,225
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	107	12,641	1,239	1,580	2,847	7,430	5,187	19	12,626	5,852	1,569	51,097

Appendix 21-2--Master's degrees: Summary of 1985-86 projected graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster											
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	435	53	72	--	178	483	--	351	175	83	1,830
Manufacturing and Processing Scientists and Engineers	--	--	89	42	--	--	483	--	264	--	--	878
Sales and Service Representatives and Purchasing Agents	6	217	--	6	93	237	80	--	88	234	42	1,003
Administrators, Managers, and Financial Advisors	--	760	--	--	139	--	--	--	175	--	41	1,115
Educators	--	217	36	--	325	237	241	--	88	234	42	1,420
Media Specialists	--	--	--	--	232	--	--	--	--	--	--	232
Agricultural Production and Management Specialists	3	217	--	--	47	59	--	--	--	58	--	384
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	326	177	--	90	471	323	--	790	469	209	2,855
Continue education												
Do not enter labor force												
Enter job unrelated to academic degree												
Return to native country												
Miscellaneous reasons												
Total	9	2,172	355	120	926	1,182	1,610	--	1,756	1,170	417	9,717

Appendix 21-3--Doctoral degrees: Summary of 1985-86 projected graduates with Agriculture degrees/Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences		Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
						Ph.D	D.V.M.						
Scientific and Professional Specialists	--	75	8	64	6	141	1,440	52	--	118	114	61	2,079
Manufacturing and Processing Scientists and Engineers	--	--	33	21	--	--	200	77	--	53	--	--	384
Sales and Service Representatives and Purchasing Agents	--	--	--	--	--	--	160	--	--	--	--	--	160
Administrators, Managers, and Financial Advisors	--	75	--	--	--	--	--	--	--	--	--	--	75
Educators	--	50	3	21	21	159	200	77	--	53	171	53	808
Media Specialists	--	--	--	--	6	--	--	--	--	--	--	--	6
Agricultural Production and Management Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Miscellaneous Agricultural Specialists	--	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	49	29	--	8	53	--	51	--	38	95	37	360
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	--	249	73	106	41	353	2,000	257	--	262	380	151	3,872

Appendix 21-4--Total Agriculture/Agriculture-related degrees: Summary of 1985-86 projected graduates with Agriculture degrees/ Agriculture-related degrees aggregated by educational cluster and distributed by occupational cluster

Occupational cluster	Educational cluster												
	General Agr.	Agr. Business and Management	Agr. Engineering	Agr. Related Sciences	Agr. Social Sciences	Animal Sciences (1/)	Animal Sciences D.V.M.	Food Sciences	International Agr.	Natural Resources	Plant Sciences	Soil Sciences	Total
Scientific and Professional Specialists	--	1,142	433	1,321	291	913	1,440	3,128	--	4,888	756	457	14,769
Manufacturing and Processing Scientists and Engineers	--	--	494	221	--	--	200	1,079	--	2,969	--	--	4,963
Sales and Service Representatives and Purchasing Agents	49	4,009	248	243	378	2,838	160	858	15	1,350	2,574	434	13,156
Administrators, Managers, and Financial Advisors	--	3,363	--	--	196	372	--	--	--	301	293	120	4,645
Educators	10	899	101	21	1,485	990	200	577	--	267	872	252	5,674
Media Specialists	--	--	--	--	665	--	--	--	--	--	--	--	665
Agricultural Production and Management Specialists	46	2,113	62	--	132	1,545	--	--	--	252	936	235	5,321
Miscellaneous Agricultural Specialists	--	632	--	--	--	297	--	259	--	631	234	--	2,053
Other	11	2,904	329	--	667	2,010	--	1,153	4	3,986	1,737	639	13,440
Continue education													
Do not enter labor force													
Enter job unrelated to academic degree													
Return to native country													
Miscellaneous reasons													
Total	116	15,062	1,667	1,806	3,814	8,965	2,000	7,054	19	14,644	7,402	2,137	64,686

1. Includes baccalaureate, master's, and doctoral degrees.

Appendix 22. Methodology used to analyze current and projected employment in the Cooperative Extension Services

USDA, SEA-Extension maintains a continuous master-personnel file of the Cooperative Extension Services' professional employees. The data in this file were reviewed January 1980, for the purposes of--

1. Categorizing Cooperative Extension personnel into two employment categories: agriculture and home economics

    a. Individuals were categorized as agricultural personnel when--

        (1) Their first and latest degrees represented a specialization in agriculture,

        (2) Their latest degree represented a specialization in agriculture, or

        (3) Their first degree represented a specialization in agriculture and their latest degree represented any specialization other than home economics.

    b. Individuals were categorized as home economics personnel when--

        (1) Their first and latest degrees represented a specialization in home economics,

        (2) Their latest degree represented a specialization in home economics, or

        (3) Their first degree represented a specialization in home economics and their latest degree represented any specialization other than agriculture.

    c. Remaining personnel, without degrees and with first and latest degrees representing specializations other than agriculture or home economics, were allocated proportionately to agriculture and to home economics.

2. Assessing 1979 levels of employment for agriculture personnel and for home economics personnel by position and by area and responsibility

3. Assessing 1970-79 annual replacements due to death, retirement, voluntary separation, or involuntary separation

In addition to reviewing the master-personnel file, estimates were developed by SEA-Extension for employment demand in the Cooperative Extension Services due to growth through 1985. These percentage estimates and derived computations are shown on the following page.

Appendix 22. Methodology used to analyze current and projected employment in the Cooperative Extension Services--Continued

Growth estimates

	Employment category			
	Agriculture		Home economics	
	Percent	Frequency	Percent	Frequency
Total growth	3.25	396	2.0	130
Position growth				
Area Agent	10.0	60	10.0	13
County Agent	60.0	200	80.0	104
State Specialist	30.0	136	10.0	13
Supervisor	--	--	--	--
Other	--	--	--	--
Total	100.0	396	100.0	130
Area of responsibility growth				
Agriculture and natural resources	50.0	198	--	--
Community and resource development	15.0	59	12.0	16
Home economics and family living	10.0	40	70.0	91
4-H and youth	25.0	99	18.0	23
Administration	--	--	--	--
Undesignated	--	--	--	--
Total	100.0	396	100.0	130

Appendix 23-1--Agricultural Business and Management:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	2	--	2	--	3
Belgium	75	8	83	--	40
Botswanna	--	5	5	--	5
Chile	4	--	4	4	4
Colombia	4	4	8	3	7
Ecuador	12	10	22	20	100
Egypt	--	--	--	--	28
Greece	2	--	2	--	2
Guatemala	7	5	12	10	8
Israel	2	--	2	1	3
Ivory Coast	4	3	7	3	10
Japan	40	6	46	40	50
Lesotho	--	15	15	8	20
Libya	5	--	5	--	--
Malaysia	--	15	15	--	1
Morocco	--	2	2	--	--
Netherlands	--	2	2	--	--
New Zealand	2	--	2	--	--
Nigeria	30	--	30	--	15
Philippines	10	13	23	--	--
Portugal	5	--	5	7	20
Singapore	9	1	10	--	6
South Africa	--	1	1	--	1
Soviet Union	4	3	7	--	12
Swaziland	2	8	10	3	15
Syria	--	1	1	2	4
Taiwan	5	--	5	--	4
Thailand	32	--	32	--	45
Uruguay	2	--	2	--	3
Zaire	9	7	16	6	22
Total	267	109	376	110	428

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1. Includes agricultural business, farm, and ranch management.

Appendix 23-2--Agricultural Education:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	3	--	3	--	5
Belgium	5	--	5	--	5
Botswanna	1	--	1	--	1
Chile	2	--	2	2	2
Colombia	2	2	4	4	6
Ecuador	10	--	10	70	110
Egypt	--	--	--	--	4
Greece	3	1	4	--	5
Guatemala	1	--	1	4	10
Israel	3	2	5	2	4
Ivory Coast	1	--	1	--	--
Lesotho	4	10	14	6	12
Malaysia	6	6	12	--	6
Morocco	4	--	4	--	--
Netherlands	4	--	4	--	--
New Zealand	7	--	7	--	5
Nigeria	4	--	4	--	10
Philippines	--	32	32	7	7
Portugal	1	--	1	3	6
Swaziland	--	20	20	20	15
Taiwan	1	--	1	--	--
Thailand	2	--	2	2	2
Zaire	26	21	47	7	54
Total	90	94	184	127	269

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1. Includes formal and informal educational programs with government, business and industry, and schools; does not include faculty employed by U.S. colleges and universities to teach abroad.

Appendix 23-3--Agricultural Engineering:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	2	--	2	--	3
Belgium	10	--	20	--	5
Chile	1	--	1	1	1
Colombia	2	1	3	3	5
Ecuador	12	10	22	20	100
Egypt	--	--	--	--	12
France	2	--	2	--	--
Greece	7	--	7	--	7
Guatemala	1	--	1	10	10
India	--	--	--	--	1
Israel	--	--	--	--	--
Ivory Coast	2	--	2	--	--
Lesotho	--	4	4	5	8
Libya	4	--	4	--	--
Malaysia	--	6	6	--	--
New Zealand	2	--	2	--	1
Nigeria	--	--	--	--	15
Philippines	--	2	2	--	--
Portugal	2	--	2	1	4
Swaziland	--	13	13	--	13
Thailand	1	--	1	--	5
Zaire	4	--	4	30	34
Total	52	36	88	70	224

1. Includes agricultural engineering and agricultural mechanization.

Appendix 23-4--Agricultural Social Sciences:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	2	--	2	--	4
Belgium	5	--	5	--	5
Botswanna	2	4	6	--	6
Chile	3	--	3	3	3
Colombia	1	--	1	--	--
Ecuador	3	--	3	10	20
Egypt	--	--	--	--	4
Guatemala	--	--	--	2	2
India	--	--	--	--	1
Israel	1	--	1	--	1
Lesotho	--	2	2	5	6
Malaysia	1	--	1	--	1
New Zealand	1	--	1	--	2
Nigeria	--	--	--	--	2
Philippines	1	2	3	7	7
Portugal	--	--	--	1	2
Swaziland	--	7	7	--	5
Thailand	--	--	--	--	3
Venezuela	1	--	1	--	--
Zaire	3	4	7	2	9
Total	24	19	43	30	83

[1] Includes agricultural communications and journalism, agricultural law, and rural sociology.

Appendix 23-5--Animal Sciences:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	15	--	15	--	20
Belgium	5	--	5	--	5
Botswanna	1	1	2	--	2
Chile	2	--	2	2	2
Colombia	10	7	17	5	12
Ecuador	8	2	10	20	60
Egypt	--	--	--	--	8
Greece	9	--	9	--	10
Guatemala	2	5	7	7	15
India	--	--	--	--	1
Israel	4	--	4	--	3
Ivory Coast	2	--	2	--	--
Japan	--	1	1	--	1
Lesotho	1	7	8	5	10
Malaysia	--	15	15	--	--
Netherlands	--	1	1	1	--
New Zealand	28	--	28	--	10
Nigeria	14	--	14	--	20
Philippines	1	19	20	--	--
Portugal	--	--	--	1	2
South Africa	--	1	1	--	1
Spain	2	--	2	--	--
Swaziland	--	1	1	--	3
Taiwan	3	--	3	1	2
Thailand	1	--	1	--	3
Turkey	1	--	1	1	2
Uruguay	1	--	1	--	3
Zaire	7	2	9	1	10
Total	117	62	179	44	205

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1. Includes livestock, dairy, poultry, animal breeding, animal nutrition, animal health, and animal physiology.

Appendix 23-6--Food Science:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
Responding country	Non-Federal workers	U.S. Federal workers	Total		
Argentina	10	--	10	--	12
Belgium	10	--	10	--	5
Botswanna	--	--	--	--	--
Chile	5	--	5	5	5
Colombia	8	2	10	10	18
Ecuador	10	--	10	20	60
Egypt	--	--	--	--	5
Greece	2	--	2	--	3
Guatemela	3	--	3	4	10
India	4	2	6	--	7
Israel	6	--	6	2	5
Ivory Coast	1	--	1	--	--
Japan	2	1	3	--	--
Lesotho	--	5	5	2	5
Malaysia	4	--	4	--	4
Netherlands	--	2	2	--	--
New Zealand	1	--	1	--	--
Nigeria	3	--	3	--	--
Philippines	8	8	16	--	--
Portugal	1	--	1	1	3
South Africa	--	--	--	--	4
Taiwan	5	--	5	--	4
Thailand	--	--	--	--	4
Turkey	1	--	1	--	1
Zaire	--	--	--	--	--
Total	84	20	104	44	155

[1] Includes dairy industry, food technology, food engineering, food distribution, food packaging, human nutrition, and dietetics.

Appendix 23-7--Natural Resources:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	4	--	4	--	6
Belgium	5	--	5	--	5
Chile	1	--	1	1	1
Colombia	2	4	6	3	4
Ecuador	8	--	8	30	120
Egypt	--	--	--	--	3
Greece	--	2	2	--	1
Guatemala	1	--	1	5	--
India	--	--	--	--	1
Israel	1	--	1	--	1
Ivory Coast	1	--	1	--	--
Lesotho	--	7	7	4	6
Malaysia	5	6	11	--	5
New Zealand	8	--	8	--	3
Nigeria	--	--	--	--	15
Philippines	2	10	12	--	--
Portugal	--	--	--	1	2
Spain	43	--	43	--	--
Swaziland	--	7	7	--	--
Thailand	3	--	3	2	10
Zaire	4	27	31	3	34
Total	88	63	151	49	217

1. Includes fisheries, marine biology, water resources, wildlife management, park and recreation management, forest products utilization, urban forestry, and forest engineering.

Appendix 23-8--Plant Sciences:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
Responding country	Non-Federal workers	U.S. Federal workers	Total		
Argentina	10	--	10	--	12
Belgium	5	--	5	--	5
Botswanna	1	3	4	8	12
Chile	2	--	2	2	2
Colombia	3	4	7	4	6
Ecuador	15	--	15	30	60
Egypt	--	--	--	--	12
France	1	--	1	--	--
Guatemala	10	4	14	10	18
India	1	--	1	--	1
Israel	1	1	2	--	--
Lesotho	--	13	13	--	6
Malaysia	1	5	6	--	1
Netherlands	--	1	1	--	--
New Zealand	4	--	4	2	4
Nigeria	50	--	50	--	10
Philippines	1	45	46	--	--
Portugal	--	--	--	1	2
South Africa	--	--	--	--	--
Swaziland	--	--	--	9	7
Taiwan	3	--	3	--	3
Thailand	5	4	9	1	10
Turkey	2	--	2	1	4
Zaire	17	5	22	2	24
Total	132	85	217	70	199

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1. Includes agronomy, horticulture, landscape architecture, ornamental horticulture, plant breeding and genetics, range management, and turf management.

Appendix 23-9--Soil Sciences:[1] Responses to Foreign Agricultural Service survey on international employment of U.S. citizens in Food- and Agriculture-related positions

Responding country	Number of U.S. citizens employed (1979)			Additional U.S. citizens needed to meet 1979 national needs	Estimated total number of U.S. citizens needed to meet 1985 national needs
	Non-Federal workers	U.S. Federal workers	Total		
Argentina	6	--	6	--	8
Belgium	5	--	5	--	5
Botswanna	--	--	--	1	1
Chile	2	--	2	2	2
Colombia	4	2	6	4	7
Ecuador	2	--	2	10	20
Egypt	--	--	--	--	3
Greece	5	--	5	--	5
Guatemala	1	1	2	5	7
India	--	--	--	--	1
Israel	1	--	1	--	--
Ivory Coast	1	--	1	--	--
Lesotho	--	14	14	--	10
Malaysia	1	6	7	--	1
New Zealand	2	--	2	--	1
Nigeria	25	--	25	--	10
Philippines	--	2	2	7	7
Portugal	--	--	--	1	2
Spain	3	--	3	--	--
Thailand	--	--	--	--	5
Turkey	1	--	1	--	--
Zaire	6	--	6	2	8
Total	65	25	90	32	102

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1. Includes soil conservation, soil management and fertility, soil chemistry, soil microbiology, and soil physics.

*U.S. GOVERNMENT PRINTING OFFICE : 1980 0-310-944/SEA-142